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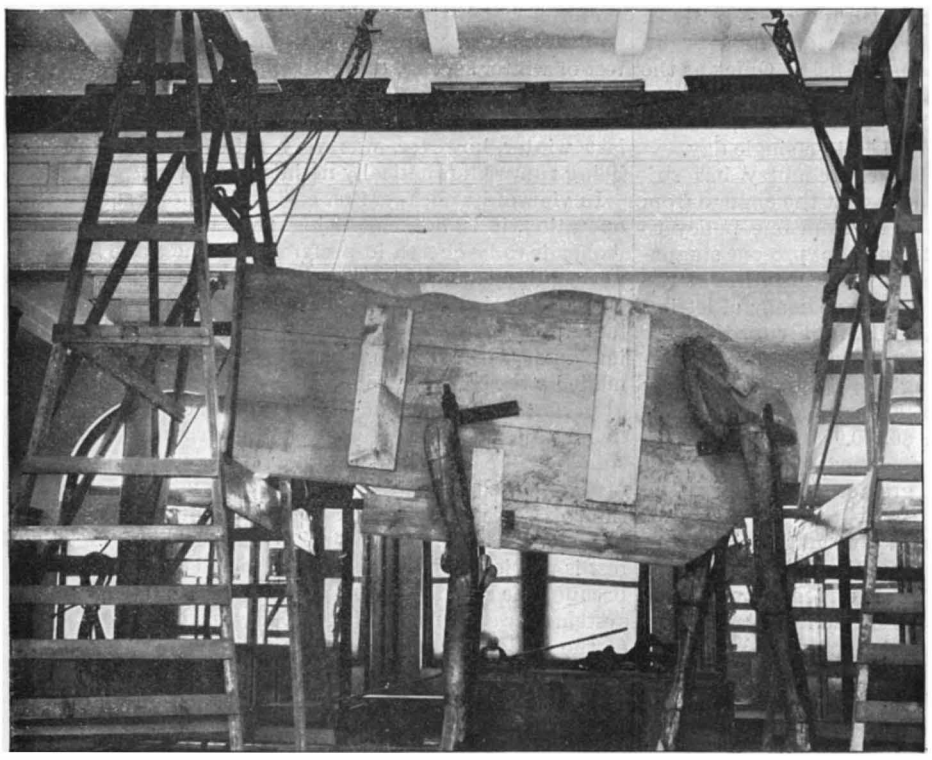

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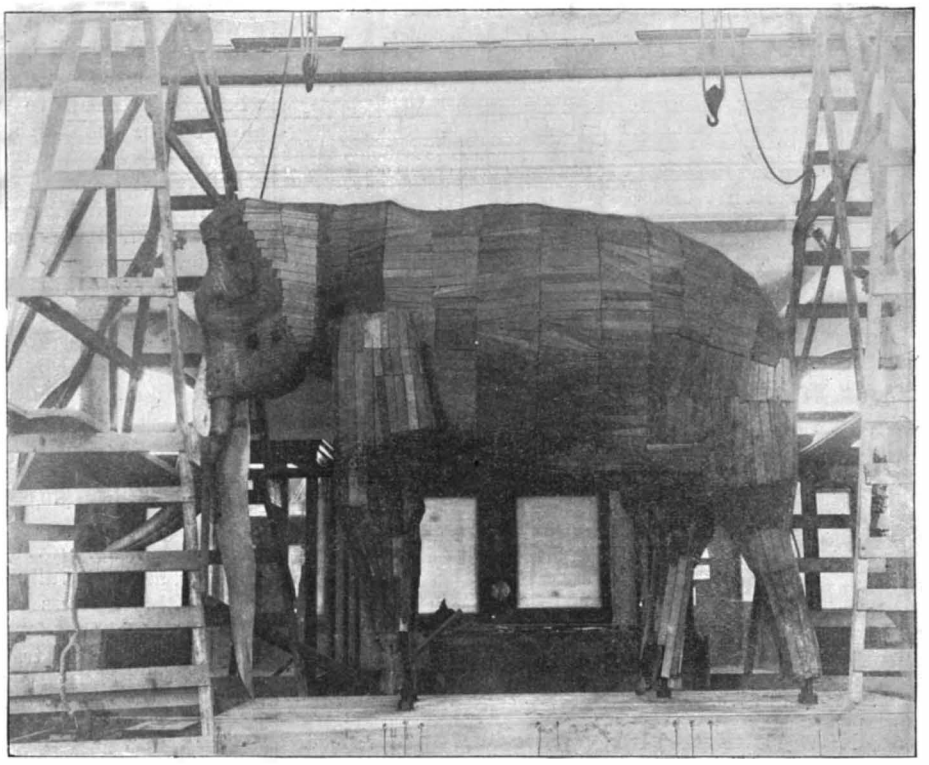

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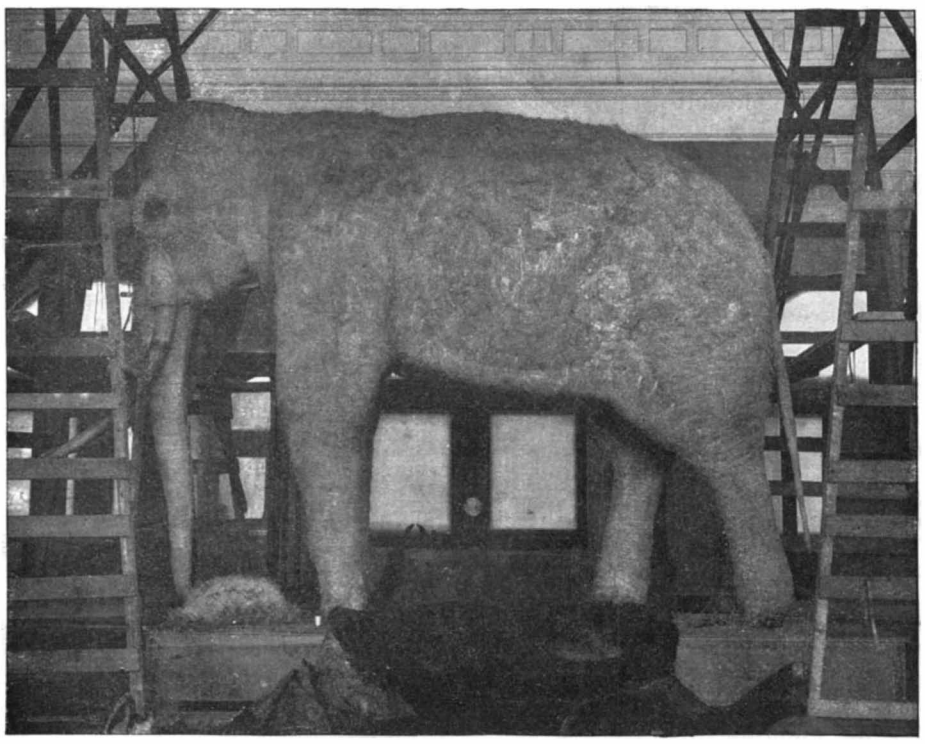

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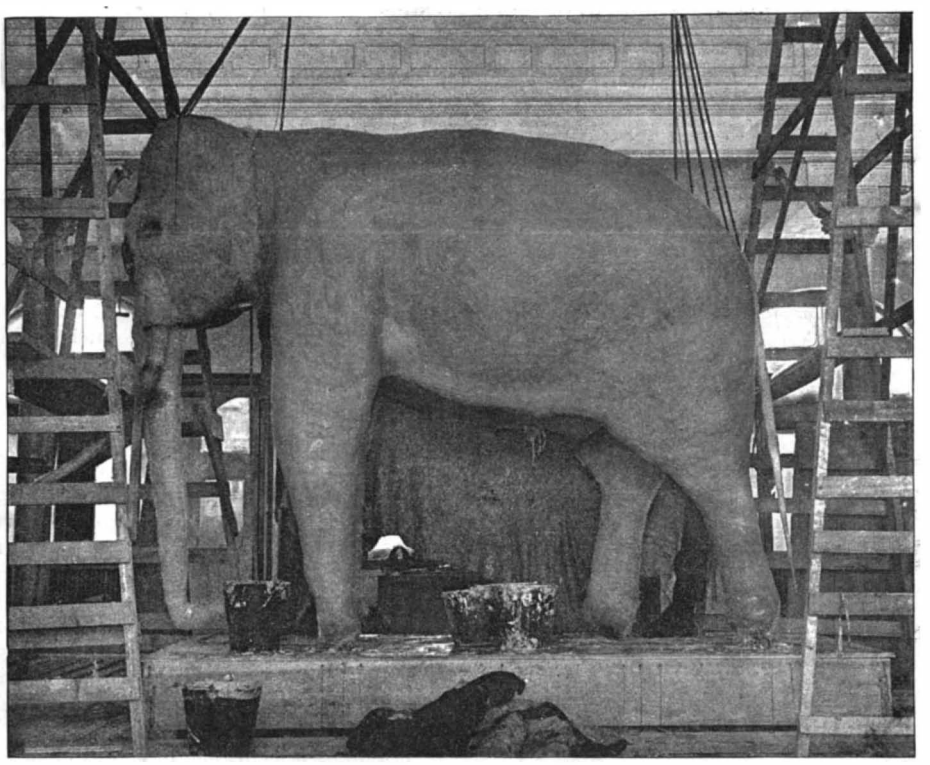

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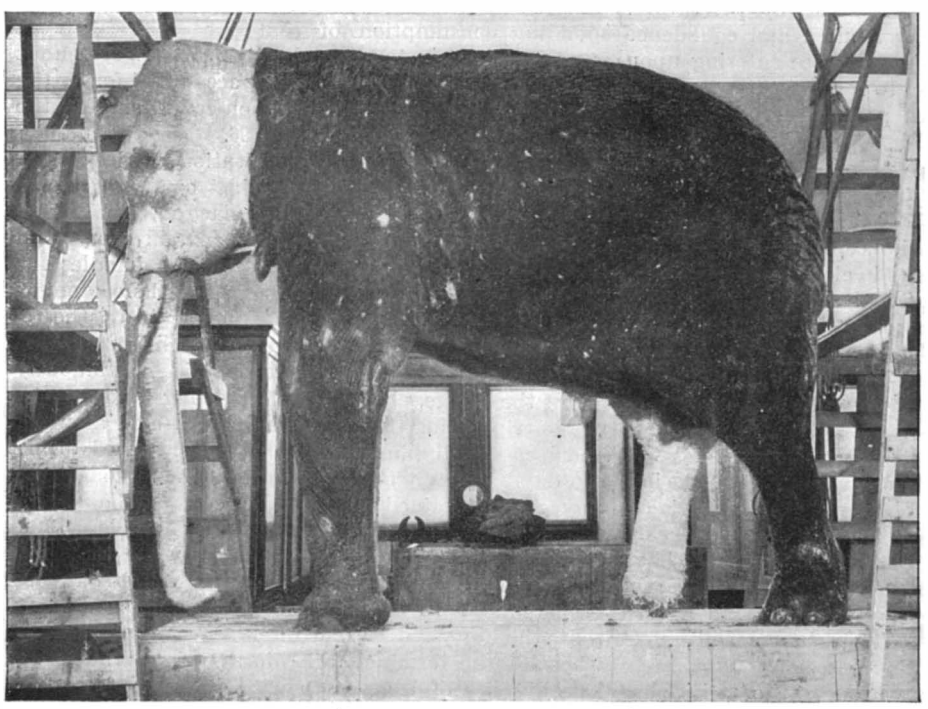

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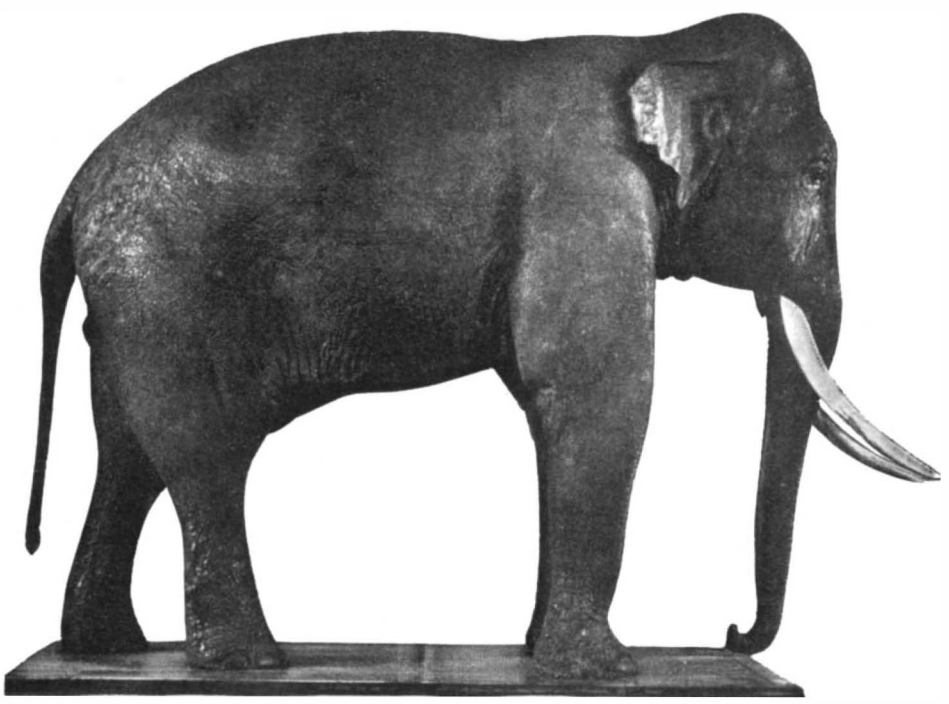

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THE AMERICAN MUSEUM OF NATURAL HISTORY—MOUNTING THE ELEPHANT "TIP."—[See page 441.]

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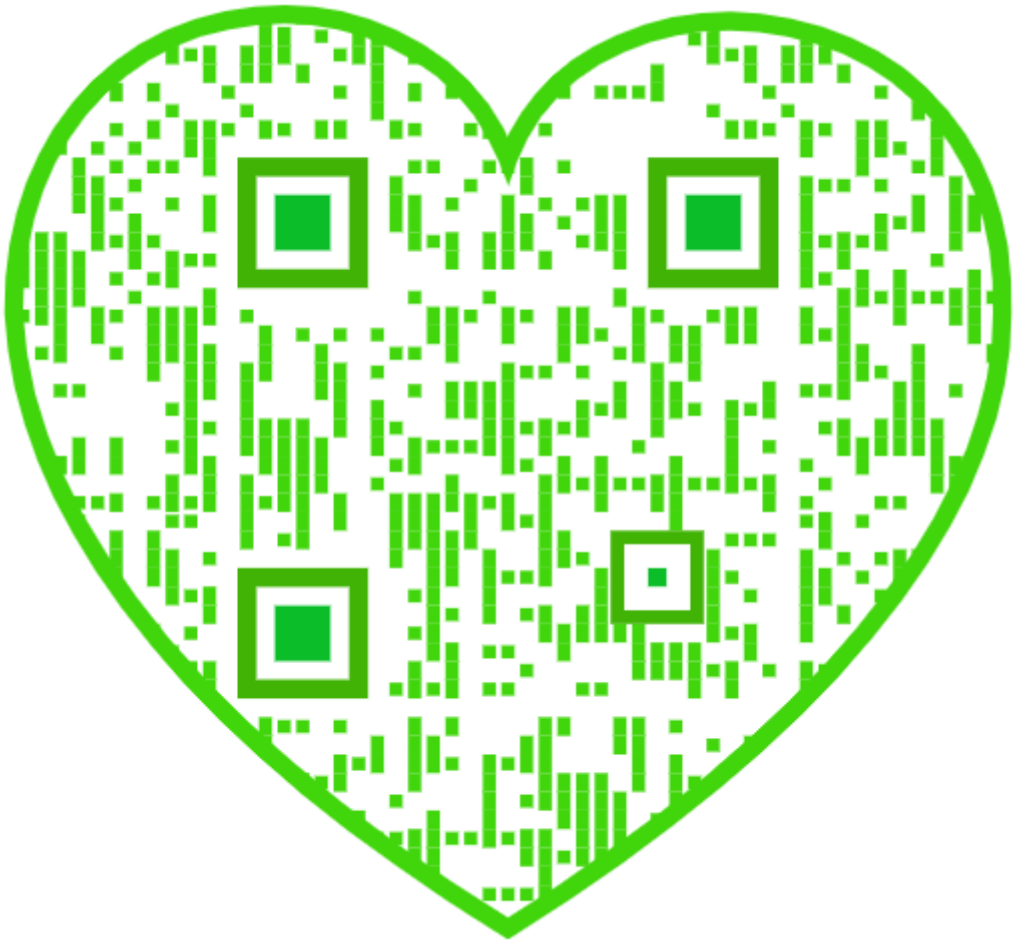

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THE PRESIDENT'S MESSAGE.

The dignified conservatism, the studied moderation of the President's message, is what is most needed at the present juncture in our national affairs. Many of the troubles with which the country is oppressed have sprung from over-speculation and an unfortunate disposition to boost the wheels of progress by artificial means, legislative or otherwise. In the race for wealth and population many sections of the country have overrun themselves, and they are only now enjoying a slow recovery. In a certain degree, this is true of the business of the country at large, and what it now needs above everything else is that it should be let alone and, if we may use the phrase, that nature may be given a chance to assert itself. Our credit is only now beginning to recover from the collapse of 1893. Quick as the wheels of credit are to stop, they are always slow to move again. Its inertia is hard to overcome, and its forward movement may be checked in a single day.

It is possible that the trade of the country has suffered from overmuch legislation; that the change from pillar to post, the perpetual seesaw from one policy to another, is largely answerable for the present stagnation. We need a rest—at least from legislation of the radical and sweeping kind. The expediency of letting matters run as they are for a while, if only for the sake of rest, is suggested by the encouraging figures showing our volume of trade during the fiscal year ending June 30, 1896, when our imports increased over those of the previous year more than $6,500,000, and the value of the domestic products exported and marketed abroad is nearly $70,000,000 greater than that of the preceding year.

This is certainly a very remarkable and encouraging showing, and it is fully in line with the conservative spirit of his address that the President should implicitly suggest that for the present at least legislation affecting our foreign trade relations should be left in statu quo.

In this connection we would suggest that the most effective means for opening foreign markets and establishing active commercial relations is that which we outlined in a recent issue, and which is now being carried out by the National Association of Manufacturers. This organization, it will be remembered, is establishing exhibition warehouses for the display and sale of American products of various kinds in the South American states. By hiring suitable exhibition rooms and the appointment of a regular staff of competent salesmen, acquainted with the language and wants of the people, it seeks to familiarize merchants of those countries with such American products as they can purchase to advantage. Here is a practical field of enterprise which can do more for the extension of American trade than whole volumes of legislation. It is practical, business-like, and, therefore, full of the promise of success.

The tone of the message is equally conservative in matters of foreign policy. In spite of the diplomatic success which has attended the Venezuela negotiations, the subject is dismissed with a modest reference; and while the language in speaking of our relations with the Spanish government is dignified, it deals with the question of the hour in a moderate and conciliatory spirit, which the more rash and impetuous spirits in Congress would do well to carefully consider. The foreign complications of the past year have taught, above all things, the lesson of moderation and the value of sober second thought. It is the exercise of these qualities which has brought us to the threshold of a permanent arbitration tribunal with the other great branch of the English speaking race; and also saved us from a step in relation to Cuba which recent developments show would have been decidedly premature. With a sound financial policy assured and confidence restored there is nothing to prevent our entering upon a new era of prosperity equal to if not greater than the period of commercial growth preceding the agitation and collapse of 1893.

THE UNDERGROUND TROLLEY AND THE THIRD RAIL IN ELECTRIC TRACTION.

Two powerful transportation companies which have been carrying out experiments in electric traction have recently taken steps to extend their electrical equipment to new divisions of their systems. The New York, New Haven and Hartford Railroad Company, whose trial of the third rail system on the Nantasket line has been closely watched by the electrical world, is intending to lay a third rail at various points on its property during the coming year, and it is officially announced that construction of a three rail electrical equipment on the line between New Britain and Hartford, via Berlin, is assured. The other installation is to be made by the Metropolitan Traction Company of New York, who have decided to adopt mechanical motive power in place of horses on the Fourth Avenue and Sixth and Eighth Avenue lines in this city. The change will affect forty-three miles of the existing lines.

The Metropolitan Company is one of those which has been making careful tests of the compressed air motor; it is also the owner of the Broadway cable road and the electric underground trolley road on Lenox Avenue; the compressed air experiments having been carried out on the last named branch. The company is, therefore, in a good position to judge of the relative performance of these three forms of mechanical traction, and there is food for thought in the fact that in the meeting of the directors in which it was determined to make the above mentioned change the weight of opinion was in favor of using the electric trolley in preference to the cable or compressed air. The underground cable was rejected on the ground of its great first cost as compared with the underground trolley, the amount of excavation, concreting and iron work being considerably less for the electrical conduit. The only question on which the company had any fears for the trolley was in regard to its ability to stand the hard test of winter service, especially when there was an accumulation of snow or slush. The behavior of the Lenox Avenue line during the severe snowstorms of last winter, however, was very satisfactory, the cars being run with practically no interruption.

In view of its cheaper first cost and uniform success in operation, it is not surprising that the underground trolley is to be chosen in preference to the cable for the new equipment, but that it should have competed successfully against the Hoadly compressed air motors is a fact which will surprise those people who have been impressed with the claims of economy which have been made by the company for the recent application of compressed air. The present costly experiments—there are five compressed air motors in operation and two more shortly to be so—were not undertaken until the engineers of the company had made an exhaustive examination on the spot of the various self-contained motors, gas, oil, and compressed air, in European cities. The test is particularly valuable for purposes of comparison, because the conditions are precisely the same for both systems, the compressed air cars being run over the tracks of the underground trolley line. The electric and the compressor plants, moreover, are located under the same roof and probably use the same fuel, all the conditions indeed being excellent for a comparative test. If the air motors are as satisfactory as is claimed, the Fourth and Sixth Avenue lines would furnish an excellent opportunity to use them on a large scale; and the fact that the trolley line is to be put in suggests that the old difficulties, which years ago baffled the designers of compressed air motors, have yet to be overcome.

The announcement that the New Haven Railroad is intending to make a further application of electricity to its steam roads will be taken as evidence that the present Nantasket electric line has given better results than the steam-equipped road. If this be the case, electric traction has taken another step in the direction of its application to the trunk roads of the country, and this goal for which electrical engineers are striving is brought within measurable distance.

At a recent discussion of electric traction under steam railway conditions, at the American Institute, New York, Mr. Charles K. Stearns stated that the chief object in view in equipping this line was to demonstrate that an electrically equipped road could be operated as satisfactorily in regard to the facility of handling large numbers of passengers on time as a steam road, and that it could was proved beyond a doubt. The line has now been in operation for two seasons. In 1895 there were 6·86 miles of double track equipped with special trolley wire, and the train schedule called for 150 trains a day. In 1896 there was the same length of trolley line and 3·64 additional miles of double track equipped with the third rail, over which 68 trains on an average were run per day. According to the table, showing the operation of the power stations during July, 1895 and 1896, the average electrical horse power per hour was 245 in 1895 and 349 1/10 in 1896, the corresponding consumption of coal per electrical horse power hour being 4·24 pounds for 1895 and 2·99 pounds for 1896. The difference is partly accounted for by the fact that the engines were run non-condensing in the former year and condensing in 1896.

Another much talked of substitution of electric for steam traction is that which has just commenced operation on the Brooklyn Bridge. In place of the switching engines at each end of the road, one car in every train is equipped with an electric motor, and handles the train from the time the cable is dropped before entering the station until it is picked up again on the return journey. A third rail is used, which is placed on the outside of the track, and is laid continuously across the bridge, electric traction being used for the whole trip during the hours of lighter travel at night and in case of slipping of the cable. It is not used during the day because it is considered that the regular headway is maintained with more certainty and the danger of collision reduced by using the cable. Thus far the work of the electric motors at the terminals has been a pronounced success. The headway has been reduced to an extent which makes it evident that the forty-five second interval will be attained when all the terminal switching tracks are utilized. The absence of the exasperating jolts which accompany the coupling on and starting of steam locomotives is very noticeable.

The success of the New Haven trials raises the question

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as to when we may look for the application of electricity to the heavy and fast traffic on our trunk roads. The most that can be said is that they give additional cause to hope that the inherent difficulties of the problem are not insurmountable. The third rail system of transmission gives promise of a reduction in the first cost of transmission, and the possibilities of economy in the use of the alternating current have yet to be put to a practical test.

On the other hand, we must bear in mind, with regard to the New Haven trials, that it is a far step from comparatively light local traffic at moderate speeds to the fast, long distance runs with heavy trains, which are being made with increasing frequency and at accelerating speeds by our leading roads.

ARMORED TORPEDO BOATS.

Naval experts, in writing the history and pointing the lessons of the late war between China and Japan, have complained of the scarcity of results having any practical value to the student of naval warfare. This was chiefly due to the incapability or cowardice of the Chinese and to the unprepared state of their navy, which was both undermanned and short of ammunition.

In cases where the Chinese did stand by their guns and fight their ships with any show of courage, as in the case of the two battleships which bore the brunt of the Japanese onslaught at the Yalu, the lessons of the war are numerous and valuable.

In the main it is to the Japanese that we must turn for object lessons, and thanks to their skill and pluck, they are many and valuable, particularly in those operations of the war in which the torpedo boat was engaged. One of the notable features of the various attacks made by these little craft was the performance of a special type of boat named the Kotaka, which differed from the ordinary torpedo boat in having armor protection. She was built about eleven years ago by Messrs. Yarrow & Company, of London, and embodied some novel ideas, the chief of which was the application of an extra thickness of plating to protect the engines and boilers. The Kotaka was selected to lead two important and hazardous torpedo attacks, and whereas the unarmored boats suffered severely from the rapid fire guns of the enemy, the Kotaka came through with comparatively little damage. The occurrence was significant, and it has again directed attention to the question of giving armor protection to torpedo boats. The Santa Fe, which we illustrate in our SUPPLEMENT of this week, is one of four armored torpedo boat destroyers which the builders of the Kotaka have in hand for the Argentine Republic. The value of armor to a torpedo boat is unquestioned, and it would be placed upon every craft of this kind were it not for the fact that its weight reduces the speed by at least a knot, and speed is the absolutely essential quality in a torpedo boat or a destroyer. On the other hand, it is reasonable to argue that as between a 27 knot boat unarmored and a 26 knot boat with armor, the chances of running through the belt of fire and getting home a torpedo are in favor, and strongly so, of the slightly slower but protected boat.

In making her rush upon a battleship she is, it is true, one twenty-seventh longer under fire; but against this it must be admitted that she has a fifty per cent better chance to keep all but the heavy rapid fire shells out of her engine and boiler rooms and preserve her machinery intact until she shall have run in close enough to launch her torpedo.

Torpedo boat attack is largely in the nature of a forlorn hope. It is a gamble against chance, in which enormous risks are run for an enormously valuable stake. The little craft will probably be discovered by the time she is within half a mile of the ship, and if she makes the dash at full speed, it will take her about a minute to run in within firing distance. During this time she will be advancing in the teeth of a terrific fire from six pounder and one pounder rapid fire guns and from the machine guns. The darkness of the night, the excitement and haste of the gunners and the smallness of the target will cause most of these shells to miss the mark; but the hail of bullets from the gatlings and maxims will be a more deadly peril, and should these guns be once trained full upon the torpedo boat, they would tear their way through the thin plating like paper and probably with fatal effect.

It is likely that the machine gun will prove to be the most effective weapon in stopping a torpedo attack. It pours out a stream of bullets so dense that it may be likened to the rush of water from a nozzle, and when it strikes upon dirt, sand or a body of water, it causes a continuous splash, which enables the gunner very quickly to bring the stream to bear upon the target. In the confusion of a night attack and by the uncertain electric light, the machine gun fire will probably be the first to find the mark, and when once the leaden stream is playing upon a torpedo boat it will be easy to keep it there. If, then, by a slight sacrifice of speed a torpedo boat can be rendered secure against machine gun fire, good policy would seem to suggest that the sacrifice be made.

The above considerations show that speed is a relative term—that is, its value is relative. It is a quality which may easily be overrated. Of all the elements which go to make up a warship, whether great or small, it is the most showy and attractive; and rightly or wrongly, it has come to be the element to which most importance is attached. In a torpedo boat or a torpedo boat destroyer speed is, of course, of the first importance; but even here, as we have shown, its value may be largely modified by the degree of vulnerability of the ship.

The half inch armor of the Santa Fe would, of course, be penetrable by the one and the six pounder shells, but it would prove sufficient to stop the murderous hail of bullets from the machine guns. The effect of armor protection upon the crew of a torpedo boat would be to contribute to that coolness and nerve which are indispensable to a successful attack. There is no branch of the service which is so full of hardship, even in time of peace, as that which places a man beneath the hatches of a torpedo boat; and if in the supreme moment of attack the wearied crew felt that they were sheltered from the most deadly fire of the enemy, they would do better work than if they dashed in with certain death staring them in the face.

Notes from the Report of the Secretary of the Interior.

We gather from the annual report of the Secretary of the Interior that the actual public domain is now 1,849,072,537 acres. There are still vacant more than 600,000,000 acres, not including Alaska. Up to June of this year the total amount of land disposed of was 946,000,000 acres. Of this vast area, 326,000,000 acres have been disposed of since 1883, or within thirteen years. Since the passage of the Homestead Act, in 1862, 162,892,032 acres have been taken up by settlers. There have been distributed in the form of land grants to railroads 83,784,705 acres, and 1,945,045 acres have been patented to wagon roads. There are yet due to railroads and wagon roads under their various grants 114,736,639 acres. The four national parks aggregate in area 3,272,960 acres. The total area of the Indian reservations is 84,418,562 acres and of military reservations 1,397,691 acres. The secretary recommends the waste land "should be taken up by actual settlers, to whom every encouragement should be extended if they are of a character to assimilate with our people and become valuable citizens. Our law makers, however, might well consider the question seriously before disposing of any more large areas of the public domain. If the rate of disposition of the last thirteen years is continued for thirteen years to come, there will be little of the public domain outside of Alaska remaining in the possession of the government at the expiration of that time."

The secretary strongly recommends to Congress that provision should be made for reclaiming the vast stretches of arid land which occur in the Western States. He is of the opinion that 100,000,000 out of the total 500,000,000 acres of arid land might be reclaimed by systematic irrigation. He also urges that steps be taken for the preservation of our public parks, a question which cannot be too urgently brought before the notice of Congress.

On the question of pensions, we learn that there are now about 970,678 persons on the pension list, who draw about $140,000,000 per year. The object of the department, says the secretary, "has been to constitute the pension list a roll of honor," rather than to aim at any special economy, and it has sought to defeat the designs of impostors and at the same time to give full heed to the claims of the truly deserving. The total sum disbursed by the government and the cost of disbursing it during the last thirty-one years is $2,034,817,769.16. What this sum really amounts to is evident when we learn that it is short only $346,712,525 of being equal to the high-water mark of the interest-bearing public debt.

With regard to the present standing of the Indians, we learn that they now occupy 85,000,000 acres of land, and the secretary urges that they should be guarded from becoming victimized by unscrupulous speculators. He recommends that three citizens, two of them civilians of different political parties and one an army officer, should constitute a commission to conduct the affairs of the Indian Bureau. There has been no outbreak or disturbance of any kind during the year. An earnest effort is being made to render the Indians independent and self-supporting. The appropriation for the entire Indian service, for the year 1897, is $7,189,496. The total Indian population of the United States, without including the New York Indians and the five civilized tribes, is 177,235, among which there are 38,000 children eligible for the schools. During the year there were 293 Indian schools, with an average attendance of 19,121 out of an enrollment of 23,393 pupils. This does not include the pupils among the five civilized tribes or the Indians of New York.

On the subject of bond-aided railroads the secretary draws attention to the fact that the Central Pacific Railroad is in default to the government, and he states that on January 1 next $2,432,000 additional of its indebtedness, together with thirty years' interest thereon, will fall due and must be redeemed by the government. The secretary points out that Section 5 of the Act of 1862 provides that on the refusal or failure of a company to redeem its bonds, the Secretary of the Treasury may take possession of all lands which at the time of said default shall remain in the ownership of the company.

With regard to the Nicaragua Canal, the secretary points out that the act chartering the company requires it to make a report on the first Monday in December of each year to the Secretary of the Interior. A preliminary statement by the company shows that no work has been done since August, 1893. The Maritime Canal Company entered into a contract with the Nicaragua Canal Construction Company for the construction of the canal, but the latter company became financially embarrassed in August, 1893, and subsequently made an assignment of its construction contract and all its assets to the Nicaragua Company, a corporation chartered by the State of Vermont. The latter company "has not yet found itself in a position to resume the work of construction under its contract."

The secretary recommends, in reference to our national parks, that liberal appropriations be made for the completion of the road system, and that an experienced landscape architect be appointed whose skill and taste would enable him to design a comprehensive and harmonious plan for the improvement of the parks. He considers that it is undesirable that works of art should be created in the parks, but that modern ingenuity should be exercised in promoting the comfort and facility of the sightseers. It is also recommended that all private land within the limits of these parks should be acquired by the government.

The Scientific American Supplement.

Occasional inquiries from our subscribers as to what is the relationship existing between the SUPPLEMENT and the SCIENTIFIC AMERICAN suggest that this would be a timely occasion to give some account of the origin and present scope and purpose of the younger publication.

The SUPPLEMENT dates from the year of the Philadelphia Centennial Exhibition, 1876. The pages of the SCIENTIFIC AMERICAN proved quite inadequate to contain as full a treatment of this national event as the editors desired to give, and it was determined to start a sort of "overflow" publication, which should appear simultaneously with the regular journal, and carry such matter as was crowded out of its columns. The SUPPLEMENT, as the new paper was called, served also for the publication of longer and more technical papers than were considered available for the SCIENTIFIC AMERICAN. The demand for the paper was so great, and it proved so popular, that at the close of the Exposition it naturally occurred to the proprietors that there was a permanent field of usefulness for such a publication, a conviction which was strengthened by requests from many of its subscribers that its issue should not be stopped. The decision to continue the SUPPLEMENT as a regular weekly publication has been justified by its increasing popularity and by the high character of its readers.

In order to fully meet the varied tastes of the many readers of the SCIENTIFIC AMERICAN, it is necessary that the articles should be limited in space, and it is therefore not possible, however great may be their intrinsic interest or however valuable their contents from a scientific standpoint, to publish in its columns long or continued articles.

Nor is it possible in this paper to furnish space for the proceedings and discussions on the papers read at the meetings of the numerous scientific, engineering, electrical and other associations which frequently assemble in this country and abroad.

But the SCIENTIFIC AMERICAN SUPPLEMENT is devoted not only to the publication of the proceedings of these various associations, but every issue contains descriptions, accompanied with illustrations, of important engineering and mechanical work going on in Europe as well as at home, and every weekly issue contains several columns of miscellaneous items, embracing electricity, engineering, new inventions, recipes; in fact, so varied are the subjects summarized which appear in these columns, that one year's numbers of the SUPPLEMENT comprise a year book of facts on all subjects appropriate to a paper devoted as this is to the higher branches of scientific thought.

The SCIENTIFIC AMERICAN is principally confined to the industrial development of this country, but in the SUPPLEMENT this work is extended and reviews the latest and most important scientific achievements of Europe and elsewhere. The SUPPLEMENT extends and amplifies the work of the parent paper, and those readers of the SCIENTIFIC AMERICAN who wish to receive the complete work can procure the SUPPLEMENT under the favorable conditions of our combined rates, published elsewhere, even though their subscription for the parent paper has already been paid.

PROF. RAMSEY, after a series of exhaustive experiments, reports that there is every reason to believe that the elements helium and argon are non-valent; that is, are incapable of forming compounds.

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THE PERFECTED DURYEA CARRIAGE.

Motor carriages are now occupying great attention both in Europe and America, and we may look for excellent results as the consequence of this interest. Inventors, in this country at least, have been heavily handicapped by lack of funds to carry out the expensive experiments which are requisite to the perfecting of the carriage. In England there appears to be now no lack of capital, but a sad lack of practical carriages. We have already illustrated the principal carriages of domestic origin and we now present an engraving of the Duryea motor wagon, which made an exceedingly creditable run in the recent inaugural trip from London to Brighton on November 14. The Duryea carriage won the first prize in the Times-Herald race in 1895 and also the prize in the Cosmopolitan race on Decoration Day, 1896. The run to Brighton was not a race, but a "go-as-you-please" run, still the time was taken, and once started the vehicles tried to pass one another, so that it was virtually a race in spite of all efforts to make it a procession. Out of fifty entries only some thirty carriages materialized, and many of them were left by the wayside between London and Brighton, to the great delight of writers for some of the dailies and weeklies, who now had a new object of ridicule. That some of the carriages greatly exceeded the legal limit of twelve miles an hour is shown by the time in which a Bollee car covered the entire distance, which was two hours thirty minutes.

The Duryea carriages were late entries and were placed at the rear of the procession. While in the city it was not possible to turn out and pass the vehicles, but once in the open country the American carriages began to pull past carriage after carriage until they reached Reigate (22 miles) 30 minutes ahead of the next similar vehicle. Here lunch was served, and some of the carriages kept right on without waiting, which accounts for the remarkable time shown in some of the published reports; this has been the cause of much misunderstanding. When the procession reformed, the Duryea carriage again forged ahead and reached Brighton forty minutes in advance, making a total gain of seventy minutes in about four hours. The roads were very heavy on account of the rain. It is said that the Duryea wagons were the only ones which were turned over to stable boys to be cleaned off with a hose; the other carriages, having exposed parts, had to be wiped off like a locomotive.

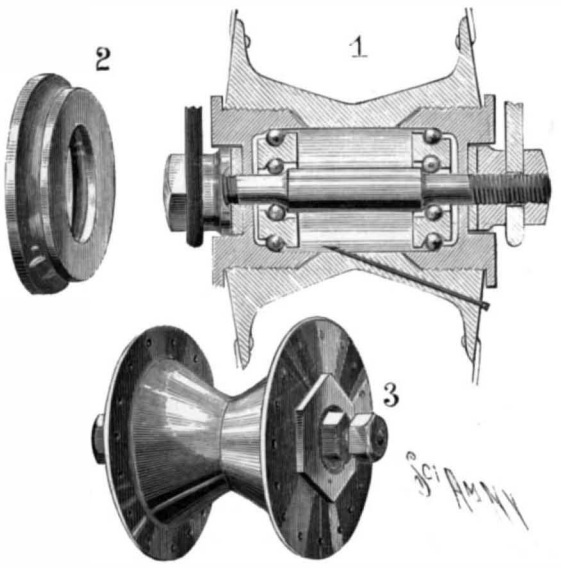
The Duryea carriage was described in the SCIENTIFIC AMERICAN for November 9, 1895. Various improvements have been introduced since that time, such as decrease of weight, an accurate adjustment of the explosive mixture, an improved muffler and arrangements for starting. While ordinary stove gasoline or naphtha is used, the motors can be quickly adjusted to use kerosene or other hydrocarbon.

Heat of Flowers.

Herr G. Kraus has investigated (Annales Jard. Bot. Buitenzorg, 1896) the extent and purpose of the rise of temperature at the time of flowering of various species of Acaceæ, Cycadeæ, and Palmæ. In Ceratozamia longifolia he found this elevation to take place only in the daytime, the maximum attained being 38·5° C., or 11·7° above that of the air. Similar results were obtained with Macrozamia. In the Acaceæ examined the period of maximum elevation is more variable, but it is never in the night. In this order the seat of the elevation of temperature is not the reproductive organs themselves, but the club-shaped appendix to the inflorescence, and it is accompanied by a rapid consumption of starch and sugar. All the plants in which this phenomenon occurs are entomophilous, and Dr. Stahl sees in it a contrivance for attracting insects to assist in pollination.

IMPROVED BALL BEARING FOR BICYCLE HUBS.

A ball bearing of simple and durable construction, designed to reduce friction to a minimum, and well



STEPHENS' FRICTIONLESS BICYCLE HUBS.

adapted for use on bicycles and other vehicles and machines, is shown in the accompanying illustration, and has been patented by Harry A. Stephens, of Missoula, Montana. Fig. 1 is a sectional view of a bicycle hub on which the improvement is applied; Fig. 3 being an exterior view of the hub, and Fig. 2 representing a novel form of bearing ring employed between the outer and inner sets of ball bearings. The stationary axle is engaged by members of the fork resting with their inner faces on nuts, whose inner faces abut against washers resting on annular flanges formed on ring-shaped bearings screwing into the ends of the hub, carrying the spokes of the wheel. The washers thus close the bearings and prevent access of dust to the inside of the hub. On the inner surfaces of each of the exterior bearings is a ball seat engaged by an outer row of balls held in a peripheral groove of an annulus or bearing ring, shown in Fig. 2, which also has an internal annular groove engaged by a second row of balls fitted onto a seat formed by the shoulder connecting the middle large portion of the axle with the outer reduced end. The ring interposed between the two rows of balls does not come in contact with any of the other parts of the device, and should a ball break in one of the rows, the other bearing would still be operative, so as not to interfere, at least for a time, with the progress of the rider. In the ordinary ball bearings, the difference in length between the outer and inner bearings causes a partial sliding of the balls, which is obviated in this case by the freely moving bearing ring, whereby the friction is reduced to a minimum.

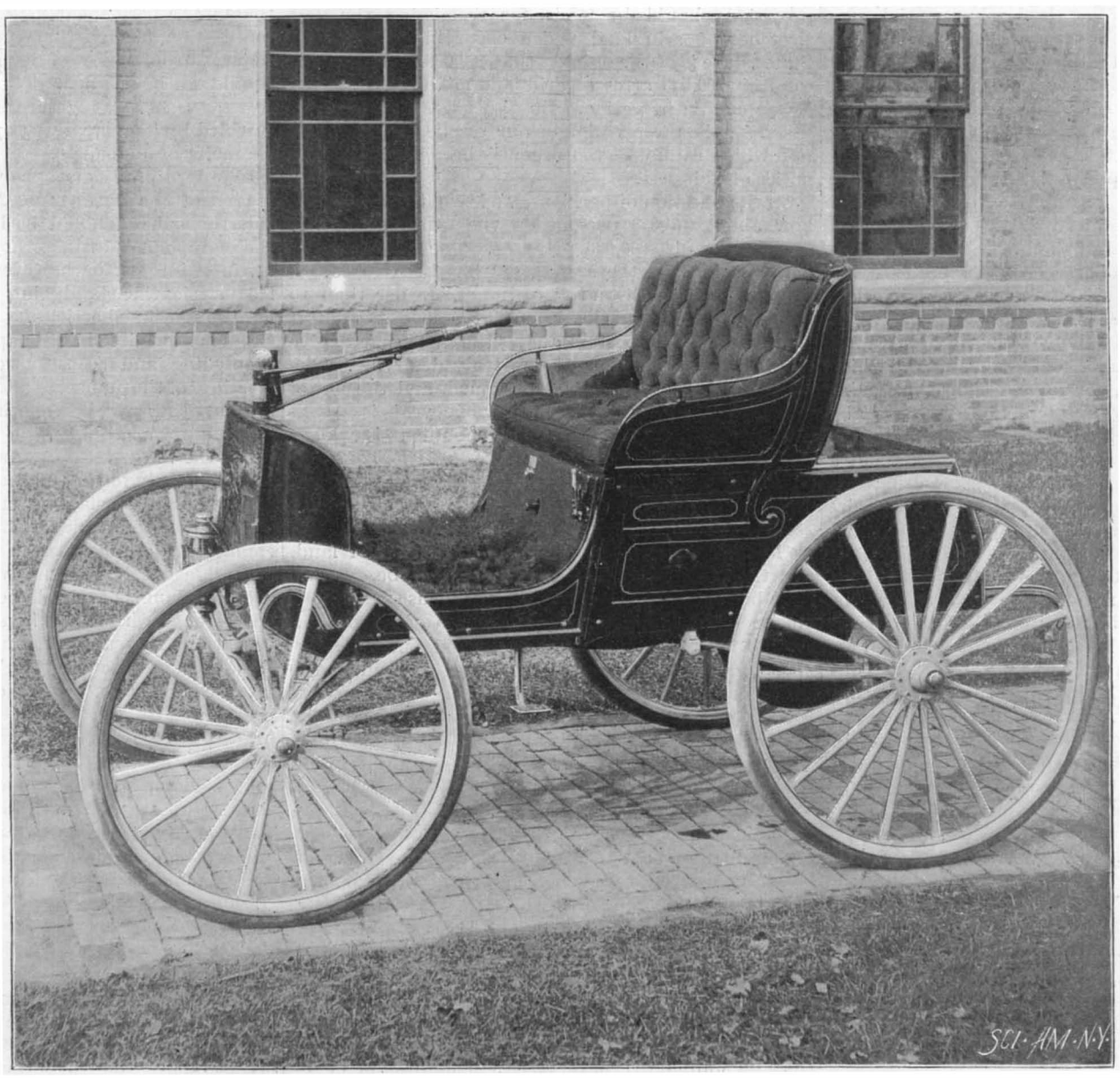
The Destruction of Sodom and Gomorrah.

The destruction of the oldest seats of civilization and culture in the Jordan Valley and the Dead Sea districts, namely, that of the four cities of Sodom, Gomorrah, Admah, and Zeboim, is one of the fixed facts of earliest tradition, and for the critical geologist the phenomenon presents no difficulty, as far as it can be traced at all. The tragedy was caused by a sudden break of the valley basin in the southern part of the Dead Sea, resulting in the sinking of the soil, a phenomenon which, without any doubt, was in intimate connection with a catastrophe in nature, or an earthquake accompanied by such a sinking of the soil along one or more rents in the earth, whereby these cities were destroyed or "overturned," so that the Salt Sea now occupies their territory. The view that this sea did not exist at all before this catastrophe, or that the Jordan before this period flowed into the Mediterranean Sea, contradicts throughout all geological and natural science teachings concerning the formation of this whole region. . . . That the Pentapolis at one time was situated in the southern part of the Dead Sea, which is now called Sebcha, is proved also, among other things, by the probable location at this place of Zoar, the place which escaped destruction in the days of Lot; in accordance, too, with the writers of antiquity and of the middle ages, including the Arabian geographers. As yet nothing certain can be determined concerning the location of the four other cities, viz., Sodom, Gomorrah, Admah, and Zeboim, of which names only that of Sodom, in Djebel Usdum, is found reflected in any place in these precincts. And even apart from geological and geographical reasons, this seems to be the natural thing, as the book of Genesis represents these places as having been thoroughly destroyed without leaving any trace or remnant behind. The fact that now these districts are a dreary waste, and by the Arabian geographer Mukaddasi called a "hill," is no evidence that in earlier times this was not different, and this valley not really a vision of paradise.—Dr. Max Blanckenhorn.

The New York Aquarium.

The New York Aquarium was formally opened on December 9, and on December 10 it was thrown open to the public, and for hours the crowd was so great that the visitors had to stand in line, 14,000 persons seeing the collection during the day. The dingy old building, which was formerly used for the reception of emigrants, has been completely transformed. Only the seven pools and the thirty-two wall tanks are in use. There is at present no exhibition in the galleries, but in time its fifty-six tanks will be stocked. The aquarium was described in the SCIENTIFIC AMERICAN for December 15, 1894. It is open daily except Sundays and Mondays. Dr. T. H. Bean is the superintendent.

THE first use of Niagara's power was made in 1725, a primitive sawmill being operated. Nothing more was done in this line until 1842, when Augustus Porter conceived the plan of hydraulic canals, and in 1861 one was completed. The Cataract Construction Company, from whose plant power has just been delivered in Buffalo, was incorporated in 1889.



THE DURYEA CARRIAGE USED IN THE RACE FROM LONDON TO BRIGHTON.

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THE AMERICAN MUSEUM OF NATURAL HISTORY—ITS COLLECTIONS AND WORK—THE MOUNTING OF THE ELEPHANT "TIP."

The assertion that those who live in a city often know least about its institutions has become a truism. It is safe to say that comparatively few New Yorkers have an adequate idea of the American Museum of Natural History, which is one of New York's most notable institutions. It was founded over 20 years ago, the original law under which its charter was acquired being passed in 1871. To the original building addition after addition has been added, a new lecture hall has been built, and to-day the richness and extent of the collection is such that in the nearly 150,000 square feet of floor space, the majority of which is now at the command of the institution, barely adequate room is found for the display of the riches of the collections. Mineralogy, geology, paleontology, botany, natural history, in all its divisions, and anthropology, are the heads under which the many collections may be grouped.

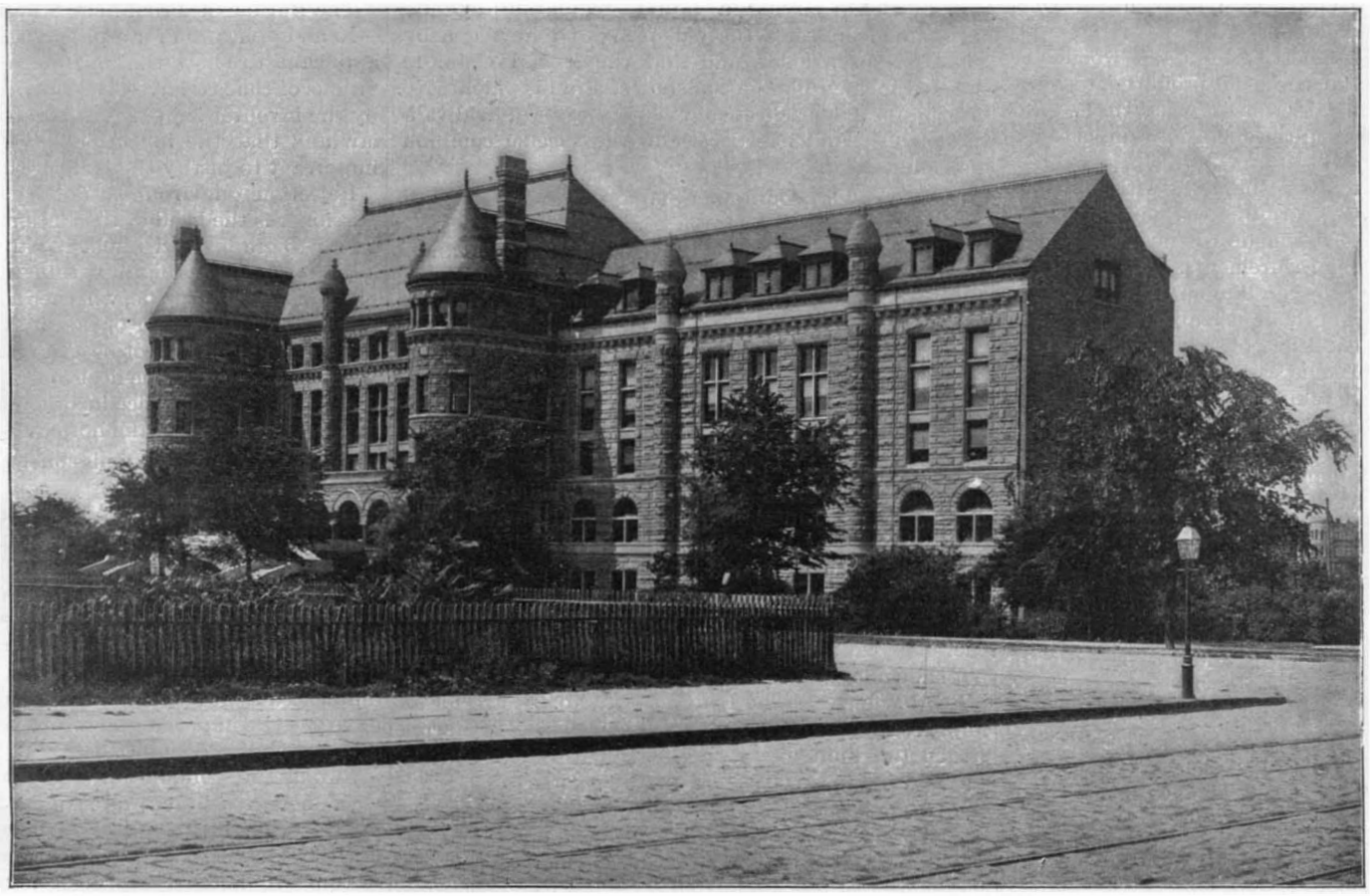
In addition to what may be termed the natural increase of the specimens, many celebrated collections have been bought or presented from time to time. Thus, under vertebrate paleontology, the famous Cope collection of fossil mammals of North America has recently been purchased, representing an expenditure of nearly $16,000. This is but an indication of the work. From many exploring and collecting expeditions, all or part of the finds are contributed to the museum. From expeditions to Peru, Honduras, Sumatra and Mexico, many unique samples have been received. The Peary Relief Expedition of 1894 greatly enriched the department of mammals and birds.

The department of anthropology, covering in its cases the cliff houses and caves of Utah, the South American Indians, mound specimens from Ohio and Kentucky and objects from British Columbia, is of special interest and richness. Another very interesting feature of the work is the department of public instruction under the curatorship of Prof. Ticknor. Here numerous lectures on travel and exploration and on subjects connected with the exhibition are given to the school teachers and the public in general.

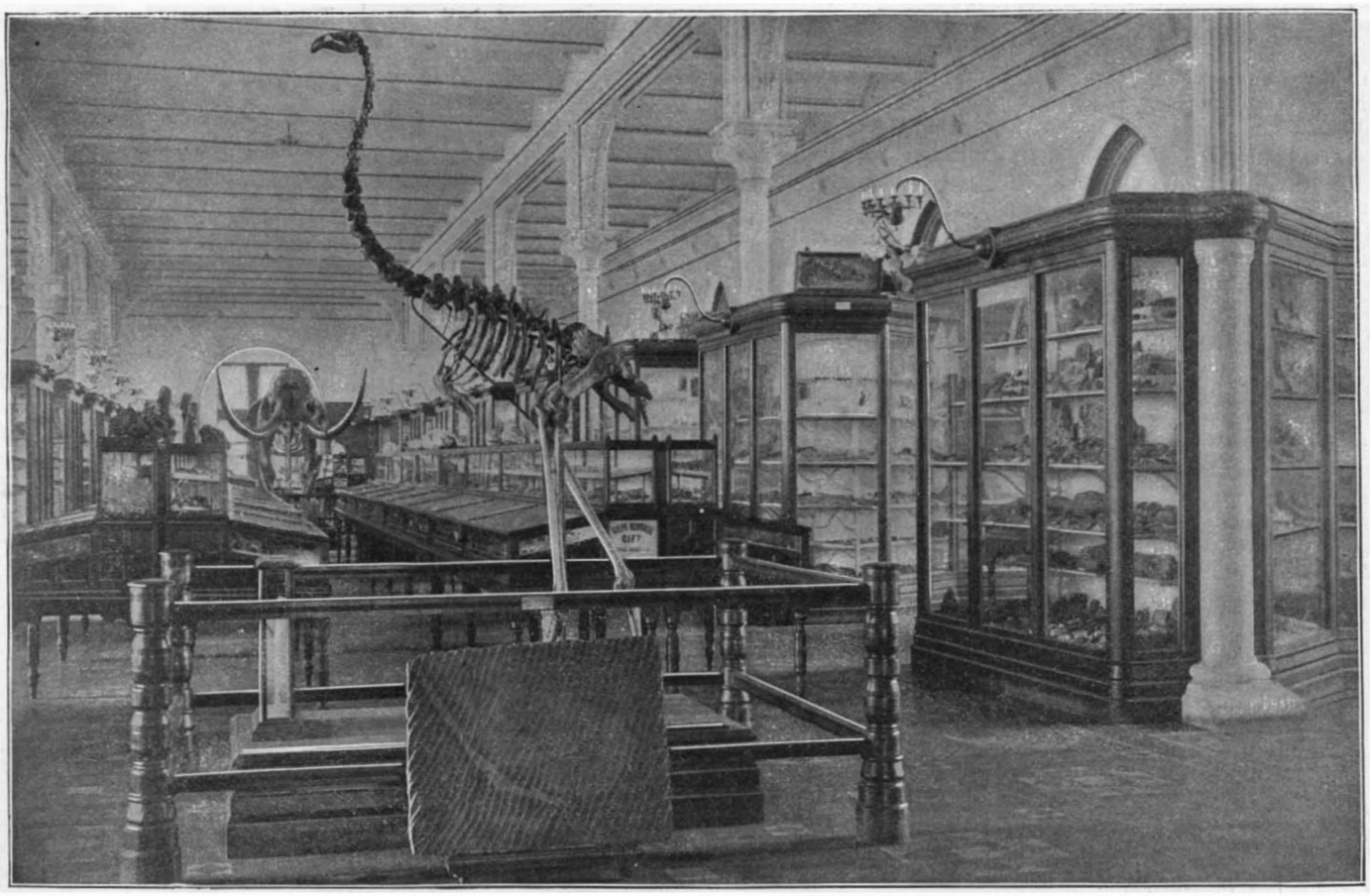
The library now numbers upward of 30,000 volumes and many maps. Books treating of forestry and botany are in special request.

Among the mineralogical specimens some samples of minerals are quite unique, from size and perfection. The Jesup collection of North American woods has at last received a permanent lodgment. It is proposed now over each of the beautifully mounted specimens of wood to place a water color drawing illustrating the leaf, flower and fruit, together with a map showing its distribution, with printed technical data.

We illustrate the outside of the building. Since this view was taken the west wing has been nearly completed, which alone represents an expenditure of nearly $350,000. An idea of the system of arranging the collections can be obtained from the view showing the hall of paleontology. Natural history is particularly well illustrated in taxidermic specimens in the world of mammals, birds and reptiles. One of the trophies of this department is the mounted skin of the elephant Tip, which impressive example of the taxidermist's art confronts the visitor as he enters the building, and of whose preparation a description is given below.



THE AMERICAN MUSEUM OF NATURAL HISTORY—THE MAIN BUILDING.



THE AMERICAN MUSEUM OF NATURAL HISTORY—HALL OF PALEONTOLOGY.

The president of the museum is Mr. Morris K. Jesup. The working staff of the institution includes the following names:

Department of Public Instruction.—Prof. Albert S. Bickmore, curator.

Departments of Geology, Mineralogy, Conchology and Marine Invertebrate Zoology.—Prof. R. P. Whitfield, curator; L. P. Gratacap and Edmund O. Hovey, assistant curators.

Departments of Mammalogy, Ornithology, Herpetology and Ichthyology.—Prof. J. A. Allen, curator; Frank M. Chapman, assistant curator; John Rowley, Jr., taxidermist.

Department of Vertebrate Paleontology.—Prof. Henry Fairfield Osborn, curator; Dr. J. L. Wortman, assistant curator; Dr. W. D. Matthew, assistant.

Department of Anthropology.—Prof. Frederic W. Putnam, curator; Marshall H. Saville, assistant curator of the archæological division; Dr. Franz Boas, assistant curator of the ethnological division.

Department of Entomology.—W. Beutenmuller, curator.

Librarian.—A. Woodward, Ph.D.

Superintendent of Building.—William Wallace.

The ever attractive and popular art of taxidermy has received great development within the last few years. The taxidermist now recognizes very thoroughly in the preparation of his objects the necessity of reproducing all the natural peculiarities of the animal's form, and by the liberal use of photographs and measurements does his best to show in his finished work the most minute featured animal, developing a real facsimile of the living creature. The old system of simply stuffing the skin until it could hold no more has been abandoned, and now the taxidermist devotes his energies to perpetuating every fold and wrinkle of the skin that existed in the original animal.

Our illustrations show different stages in the mounting of the skin of the famous elephant "Tip." This somewhat famous elephant came here in 1881, embarking from Toulon under the ownership of Carl Haagenbach. By him he was sold to Adam Forepaugh, but as the animal proved too vicious for circus use, some eight or nine years after his purchase he was presented to the Central Park Museum.

Tip had always been vicious and had the death of several keepers to answer for. While in the Central Park Museum he attacked his attendant, Snyder, nearly killing him, and the death of Tip himself was determined on. After considerable trouble a large dose of potassium cyanide was administered to him, on May 11, 1893, which killed him, at the age of twenty-three years. He was of good dimensions, 9 feet 6 inches in height and 11 feet long.

It is quite usual to use some of the bones of the original skeleton in mounting animals. In Tip's case, however, the skeleton was preserved for separate mounting. Immediately after his death the skin was removed and all the flesh was dissected from the bones, and the skin after paring down was put in tan liquor. The bones were carefully prepared for mounting en squelette. For the taxidermic figure a wooden skull

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and wooden leg bones were made in general facsimile of corresponding members of his frame. A profile board of heavy plank was cut out, representing the longitudinal section of the great body. It was sustained by four iron bars fastened by iron straps to its sides. Close to the bars were mounted the representative of the leg bones. This stage of operation is shown in Fig. 1. The wooden skull was attached to the profile board, and a pair of tusks from another elephant were attached to the wooden skull. This gave the extemporized skeleton in part. To the profile board curved ribs were now attached, and over these laths were nailed closely together so as to give the general contour of the body. A similar process was applied to the legs, they being brought to a cylindrical shape by laths running up and down, nailed to a framework surrounding the iron supporting bars and wooden leg bones. From the skull depended a profile board representing the longitudinal section of the trunk. This marked the second stage in the operation, and is shown in Fig. 2.

The next step was to cover the laths with excelsior, tied, tacked or glued on, according to the circumstances. Now constant reference was made to the photographs of the living Tip and to measurements. The skin meanwhile had been lying in the tan liquor for a year. It was scraped and pared down to a manageable thickness and was now tried on the excelsior covered elephant. This resulted in indicating the necessity for adding excelsior in some places and in taking it away in others. The skin was repeatedly tried on and the excelsior added or removed until the manikin was made to exactly fit the skin, which for ease of manipulation had been cut into three pieces. The excelsior covered core is shown in Fig. 3.

When this fitting of the manikin was complete a thick coating of modeling clay was applied all over the surface until the clay manikin, shown in Fig. 4, resulted.

The skin was now slung up and placed over the model, and was sewn in place with wire. Fig. 5 shows the work in progress. The trunk board had been padded out to give the approximately cylindrical section. Glass eyes were put in position, the eyes being constructed with great care to reproduce the colors of the true elephant's eye. After the tanning the skin was no longer the natural color. By the use of paint, varnish and some finishing touches, the proper color was restored to it and the true appearance of an elephant given to the whole, as shown in the final cut, Fig. 6. It now forms one of the most attractive objects in the museum, and represents a very complete embodiment of the art of taxidermy.

The use of clay and of the elastic excelsior gives the taxidermist great facilities in reproducing all the natural features of an animal. The modern school of taxidermy is specially well illustrated in the American Museum of Natural History. Thus, taking as example the walrus or the rhinoceros, it will be found that in both of these animals the large wrinkles or folds of the skin are very characteristic features. The modern school of taxidermy takes full cognizance of them, and often many hours and days of work are devoted to the final life-giving touches and reproduction of minute features. The stuffed animal is no longer a mounted skin; it is the reproduction of the animal itself, upon which every resource at the taxidermist's command is lavished.

Recent Patent and Trade Mark Decisions.

Osgood Dredge Company v. Met. Dredging Company (U. S. C. C. A., 1st Cir.), 75 Fed., 670.

Combinations and Aggregations.—The general rule of law is that the conception of a combination which merely brings together two or more functions to be availed of independent of each other is an aggregation and not a combination, and there is no invention in it.

Dredging Machines.—The Osgood patent, No. 257,888, for a dredging machine having a boom attached to operate either a scoop for hard soils, or a "clam shell" bucket for soft soils, has been held void as to claims 1 and 3 because it is a mere aggregation and not a combination.

Validity of a Patent as Affected by Prior Declarations of Defendant.—The fact that the defendant by advertisements and other publications has maintained the patentability of machines of the same general character as that for which he is charged with infringing is entitled to little weight in determining the validity of the patent, because whether the patent is valid or void is a matter of public concern and neither the inventor nor the infringer can be permitted to substitute his own opinions for the judgment of the court which represents the public.

Expert Testimony.—An expert witness in a patent case has no right to answer any mixed question of law and fact, and it was improper for the expert to state as his opinion that a certain alleged invention belonged to that class of inventions described by the term "new article of manufacture."

A Court Declaring a Patent Void on its Own Motion.—Because the court represents the public, and the validity of the patents is a matter of some public concern, a court has a right on its own motion to adjudge a patent invalid even if the question is not raised by the parties to the case.

Blount Manufacturing Company v. Bardsley (U. S. C. C. A., 2d Cir.), 75 Fed., 674.

Interpretation of Claims.—Where certain claims of a patent described a shaft as connected with a piston "to operate the same," and "to operate the same and be operated thereby," but failed to show how the connection was made, it was held that the connection was not necessarily an attachment incapable of separation, but such a relation of parts as would produce simultaneousness of motion between the shaft and piston, and, therefore, such claims cover a cam connection.

Door Checks.—The Blount patent, No. 289,380, for door checks, having a liquid regulating cylinder separated from the actuating spring and having a bypass, has been held valid and the second claim restricted to the combination shown, and his patent, No. 485,357, for a door check and closer, has been held valid and claims 2 and 3 restricted to the specific combinations described.

American Soda Fountain Company v. Green (U. S. C. C., Pa.), 75 Fed., 680.

What Constitutes a Combination.—A patent cannot be declared void because it is not a combination when the object to be attained by the apparatus would not be accomplished except by the mutual relation and the co-operation of the various parts.

Soda Water Fountains.—The Whitting patent, No. 414,279, has been held valid.

Long v. Polk Manufacturing Company (U. S. C. C. A., 1st Cir.), 75 Fed., 835.

Effect on Patent of New Functions.—The discovery of new uses or functions of a patented device has no effect upon the patent regardless of what the patentee may have claimed in the patent to be the functions and advantages of his invention, for the patent is on the mechanism. The discovery of a new function, therefore, cannot be used to give the patent a breadth not shown on its face.

Road Vehicles.—The Long patent, No. 281,091, for an improved steering head for road vehicles has been construed and limited.

Beach v. Inman (U. S. C. C., N. Y.), 75 Fed., 940.

Effect of Prior Decisions.—When a patentee has obtained a final decree after years of arduous litigation, sustaining the broad claims of his patent, such decree should protect him against all intruders who seek to use the actual invention by making changes in form to avoid the claims and specification; the specification and claims are not to be scanned with a hostile eye after such decision.

Paper Bag Machine.—The Buck reissue, No. 11,167, for a machine to attach stays to the corners of paper boxes as to its first two claims is again sustained and is infringed by a machine having only differences of form and in substance.

Ex parte Ernest (Commissioner's Decision), 76 O. G., 1417.

Amendment to Drawing.—If the examiner thinks the proposed amendment to a drawing involves new matter, the change in the drawings should not be allowed to be made until not only the question of new matter has been finally determined but whether the claims based thereon will be allowable, so that all questions may be settled at once on appeal.

Rewriting the Specification.—Although an application may be confused and informal, yet if the claims can be understood from the description and drawings, action should be taken on the merits.

Ex parte Stern (Commissioner's Decision), 76 O. G., 1417.

Entering Amendment to Application.—Where an amendment to an application for a patent cancels some claims and amends others, the examiner cannot admit the amendment so far as it relates to the cancellation of claims and refuse to admit it so far as it relates to the amendment of claims, but must either enter or reject the amendment as a whole, so as to enable all questions to be settled by appeal.

Ex parte McFarlane (Commissioner's Decision), 76 O. G., 1418.

Dispute as to Ownership of Patent.—The Patent Office is not the proper place to dispute the ownership of a patent, for it has no judicial functions for the determination of private rights, and where the title is disputed the patent should be granted to the inventor, leaving the question to be determined by the courts.

Pell v. Pierpoint (Commissioner's Decision), 76 O. G., 1573.

The Question of Novelty in an Interference Case.—Where the question of priority has been decided without the suspension of an interference proceeding, the question of patentability of a claim involved in the interference will be considered ex parte and not inter partes by the primary examiner.

Ex parte Grosselin (Commissioner's Decision), 76 O. G., 1573.

Affidavit against Foreign Patent.—Where a foreign patent is cited against an application, an affidavit to overcome such patent must state facts showing that the invention was completed in this country before the date of the foreign patent.

Drawbaugh v. Seymour (U. S. C. C. A., D. C.), 77 O. G., 313.

Telephone.—The applications of Daniel Drawbaugh, No. 111,554, filed 1883, and No. 536,530, filed 1884, have been rejected on the ground that Drawbaugh was not the inventor.

Affidavit Against Foreign Patent.—An affidavit to overcome a foreign patent cited against an application must not fail to state facts as to the time and circumstances of the conception of the invention and its development to completion prior to the filing date of the records.

The Burden of Proof in an Application for a Patent.—In an application for a patent the burden is on the applicant to show that all the conditions and provisions of the law have been fully complied with whereby the inventor is justly entitled to a patent under the law and that the invention is sufficiently useful and important to justify the issue of the patent.

Rejection on Grounds not Specified.—The Commissioner is the head of the Patent Office, and has the power to grant or withhold a patent, and if there be any reasonable ground within his knowledge why a patent should not issue, whether a specific objection be raised by the examiner or not, it is his duty to refuse the patent, and it is not necessary that a duly certified transcript record of the decision of a federal court be filed in the Patent Office in order to render it competent for the office to take notice thereof.

Cushman v. Lines (Commissioner's Decision), 77 O. G., 153.

Design for Oil Cans.—A slight and apparently immaterial difference in the appearance and design of oil cans is patentable.

Experiments on Animals and on Man.

Thiersch's experiments on cholera, which caused the death of fourteen mice and proved that cholera is communicated by swallowing particles of cholera discharge, have been an important factor in the sanitary legislation of every civilized country.

Two of the London water companies experimented with cholera polluted water upon 500,000 people, causing the death of 3,476 human beings in 1853-54. This is the popular accidental experiment which antivivisection writers tell us to wait for, and which they say is sent by Providence to teach men physiology. Thiersch made the same experiment upon fifty-six mice, the conditions being accurately determined and scientifically controlled, and with the death of fourteen mice gave the world more exact information about the contagion of cholera than all the cholera epidemics recorded in history. This is the scientific experiment which we are told should not be made.

The antiseptic method, which we owe in so great a measure to the vivisectional experiments of Joseph Lister, is past all reasonable controversy and we may refer to it here. It has come to be used in hospitals generally, and has reduced mortality from surgical operations to one-tenth of what it was before. Any one who has seen even a few cases of antiseptic surgery will readily agree with Dr. Keen when he says: "Sir Joseph Lister has done more to save human life and diminish human suffering than any other man of the last fifty years." Still, Lister was obliged to leave England to continue experiment in his merciful work after the passage of the restrictive law in 1876.

In the Tübingen Hospital died from amputation before introduction of Lister's method and after:

	Per cent.	Per cent.
Of lower limb	43·5	3·2
Of upper limb	30·6	2·9

—Appletons' Popular Science Monthly.

A Word to Mail Subscribers.

At the end of every year a great many subscriptions to the various SCIENTIFIC AMERICAN publications expire.

The bills for 1897 for the SCIENTIFIC AMERICAN, the SCIENTIFIC AMERICAN SUPPLEMENT, and the BUILDING EDITION of the SCIENTIFIC AMERICAN are now being mailed to those whose subscriptions come to an end with the year. Responding promptly to the invitation to renew saves removing the name from our subscription books, and secures without interruption the reception of the paper by the subscriber.

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Correspondence.

Again the Nest Building Fishes.

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN of November 28, Charles F. Gilbert criticises an article on the nest building fishes which appeared in your issue of August 1. Mr. Gilbert has evidently reference to some other fish than the Paradise fish spoken of in your issue of August 1. He will find an absolutely correct article, with an absolutely correct illustration of the nest building Paradise fish of India (Macropodus venustus), on page 95 of the "Amateur Aquarist," by Mark Samuel, the late aquarist of Columbia College, published by the Baker Taylor Company, 5 East Sixteenth Street, New York; and he will also find an illustrated article on the nest building stickleback on page 99 of the same work.

The fish Mr. Gilbert refers to he says builds no nest; but the Paradise fish does build a nest made of bubbles on the surface of the water. The fish that Mr. Gilbert speaks of he says attains a weight of twenty pounds. The adult Paradise fish measures only five inches in length.

I would like to correct a few errors in the otherwise excellent article of August 1, which refers to the real Paradise fish. As I have raised these fish for five years, and have made a constant study of their every action, my observations correspond exactly with those of Mark Samuel in the "Amateur Aquarist." The female never makes the nest. The whole process of making the nest and caring for the young is done by the male. Instead of the eggs hatching in five days, they hatch in about thirty-six hours.

Any one can raise these fish with a very little care in an ordinary small aquarium, and they are a most interesting fish, especially during the breeding season, when they change their various brilliant colors and extend their tail and fins in a very much more beautiful manner than any other fish known.

CHARLES H. LOOMIS.

The Commercial Value of Ideas.

In his lecture before the League for Political Education, at the Berkeley Lyceum, on "The Commercial Value of Ideas," Mr. Clarence Cook described a fancied visit to Parnassus, where he met Fortune riding down on her "wheel," in a bicycling costume that had been modeled upon the antique, and recalling the statue of the huntress Diana. Questioned upon her mission, Fortune said that she was carrying gifts from the muses to the men and women of the world. "You seem to be very lightly laden," said the questioner. "I have all I can carry," she replied; "for my load is made up of ideas, suggestions, and even a few happy guesses." As she sped down the mountainside she called back: "I never carry money with me, but only the means by which to make it."

From this suggestion the lecturer pointed out some ideas from which have been made fortune and fame. He found all the muses actively engaged in business—Parnassus turned into a workshop. All were busy in teaching men how to extract money from sculpture, from the writings of history, from the dreams of poetry, and even from the divine graces of the Muses' dance. Clio said that she had taught Herodotus to write history, and although his books were filled with "vain imaginings," they still had "a good sale."

Plato, he said, had called the boy "the most fearful wild beast living." Occasionally, however, the boy proves of great usefulness. Thousands of idle boys had sat lazily by their mothers' fires and seen kettle lids bobbing up and down; thousands of men, also, had seen it; but it was reserved for the boy Watt to investigate cause, and give to the world the steam engine.

Another little boy, tired of holding the skein of yarn for his mother, devised the reel, so that he could go out to play. Another, turning a crank and seeing other boys at play, looked about for some way to have his work done so that he could go out in the fields. He noticed another crank, moving simultaneously with his. He attached a wire from the other crank to his own, saw that one did the work of two, and went out to play, leaving behind him a blessing to mankind.

"We are apt to consider Nebuchadnezzar a tiresome old fellow, and he was certainly addicted to strange ways in his old age, but he first conceived the idea of canalization. Pharaoh-Necho also had the idea of canals, and first suggested the cutting of a canal through the Isthmus of Suez. In those days they had no newspapers to tell people what to do, but they had what fulfilled this function of the newspaper—the oracle. Pharaoh-Necho went, therefore, to the oracle, and it gave him exactly the same reason for not cutting the Suez Canal that the papers give now for America's not cutting a canal across Nicaragua. It said: "You are working for the barbarians." The idea was that the canal would benefit the people of the Mediterranean more than it would Egypt. We are afraid of helping some one else, but the canal will have to be cut some time. Pharaoh-Necho's plan was afterward utilized by De Lesseps, and brought him fame and fortune.

"Long ago there were three toys in China with which those people played for centuries. They were little wooden blocks, on which figures and characters were cut; a little toy machine which had a needle that, when moved about, always turned to the north, and which the Chinese found useful in sailing up and down their coasts, and the last was the firecracker. These toys are still so used in China, and would never have been of any great service to mankind if they had not been brought to Europe, where the crude ideas they embodied were fertilized by the ideas of thinkers, and then they revolutionized the world. From the little blocks of wood came the printing press; from the curious little toy of Chinese junk sailors came the mariner's compass, and from the firecrackers were evolved the cannons that battered down the feudal walls of Europe."

World's Debts Increasing.

Whether it be a good or a bad thing for the nations, there is no room to doubt that the debts of the world are growing steadily. In 1875 it was computed that they stood at £4,750,000,000, as compared with a round £4,200,000,000 two years earlier. On the basis of figures, many of which have been obtained by us at first hand, and are likely on that account to be more accurate than some of the wild guesses to which certain irresponsible statisticians have treated us, we ourselves estimate that the indebtedness of the world to-day stands at £5,800,000,000. As probably everyone knows, France has the doubtful distinction of being the country which has the largest debt. The latest figures put the total at something like £1,200,000,000, which is nearly double the debt—£660,000,000—of Great Britain, which ranks as second on the list. Russia follows with a total of £575,000,000, and insignificant Italy comes fourth with £506,000,000—that is, if we count as separate items the joint debt of Austria-Hungary and the individual debts of the two portions of the nation. The joint debt stood, in 1895, at £275,990,000; while the debt of Austria alone was £122,678,600, and that of Hungary alone £207,729,000, or £606,397,600 in all. The United States debt amounts to £339,000,000, and that of Spain—exclusive of the more recent loans in prosecution of the war in Cuba—at £279,000,000. In the following statement we give a comparison for 1875 and 1895 of the indebtedness of the nations which now owe, or did then owe, £100,000,000 or over:

Country.	1875. (Estimated.)	1895. (Estimated.)
France	£900,000 000	£1,200,000,000
Great Britain	780,000,000	660,000,000
Russia	340,000,000	575,000,000
Italy	390,000,000	505,000,000
United States	440,000,000	339,000,000
Spain	375,000,000	279,000,000
Austria-Hungary	350,000,000	606,000,000
Germany	200,000,000	84,000,000
Australasia	46,000,000	240,000,000
Turkey	135,000,000	180,000,000
Portugal	69,000,000	153,000,000
India	130,000,000	127,000,000
Brazil	94,000.000	118,000,000
Egypt	75,000,000	106,000,000
Total	£4,324,000,000	£5,172,000,000

In spite of the substantial reduction of the English, American, Spanish and German debts, there is a net increase for the fourteen nations in the twenty years of £848,000,000. It may be added that in 1885 these same twelve nations owed £4,140,000,000, made up thus: France, £998,000,000; Great Britain, £740,000,000; Italy, £455,000,000; Russia, £381,000,000; United States, £379,000,000; Spain, £270,000,000; India, £127,000,000; Turkey, £127,000,000; Australasia, £98,000,000; and Portugal, £83,000,000. In the years 1875-85 there was on this showing a net reduction of about £15,000,000 on the indebtedness of the nations enumerated; but the whole world's obligations in 1885 represented an increase on 1875, our calculations giving a total for the former of nearly £4,900,000,000. Among the minor debtors, Belgium has increased its obligations from £71,000,000, in 1875, to £91,000,000, in 1895, and in the same time the debt of the Netherlands has gone up from £80,000,000 to £92,500,000, and that of Canada from £30,000,000 to £51,300,000. The Greek debt stands at £32,984,000 and that of Mexico at £32,720,000 (as against £63,500,000 in 1875); while among the new borrowers must be reckoned Japan, which now owes £47,300,000, and the Argentine Republic, which owes about £74,000,000. For the small borrowers—Bulgaria, Denmark, Norway, Sweden, Chile, Peru, Servia, etc.—we have allowed £150,000,000, which is probably only two-thirds of the actual obligations of these nations.

The sum paid annually as interest on the world's debts approximates to £230,000,000. Twenty years ago the total was about £200,000,000, and the increase of only £30,000,000 with a capital addition of more than £1,000,000,000 is explained by the fact that money now is cheaper, provided credits are good, than it was in 1875, when on some of its loans England was paying 3¼ per cent, India, 4 per cent, Holland 4¼ per cent, Canada 4½ per cent, France, Russia, and Brazil 5 per cent, Italy and Portugal 6 per cent, Hungary 7½ per cent, Egypt 8 per cent, Turkey and Peru 10 per cent, Spain 15 per cent, and Mexico 18 per cent. France, of course, pays out the largest sum of money every year in the way of interest, the total running to about £37,000,000, or 19s. 8d. per head of the population. Great Britain's disbursement is £24,540,000, or 12s. 9d. per head. Russia pays out a little more, £24,726,000, or 4s. 11d. per head. Austria-Hungary, on the joint and special debts, pays out £37,190,000 a year, and the average per capita expenditure on the joint debt is 4s. 10d., on the special Austrian debt 10s. 10d., and on the special Hungarian debt 15s. The annual charge in Italy amounts to £23,450,000, which works out at the rate of 15s. 1d. per head. Spain pays nearly £11,300,000 interest annually, or 13s. 1d. per head. Though the capital itself is a large item, the charge per annum in the United States is no more than 1s. 9d. per head. In Uruguay, on the other hand, it runs to as much as £1 2s. 6d. per head. Burdett says that in Peru this per capita charge runs to £1 3s., but there must be something wrong with Burdett's figures. In Portugal the amount is 15s. 10d. per head, and in Egypt 11s. 10d. per head. In Germany it is no more than 1s. 4d.

Can any one say offhand what is the aggregate debt of all the English possessions in all parts of the globe? We will give the total—it is £1,097,166,600. After the mother country, India has the heaviest debt; the total being, as we have seen, £127,600,000. Then comes New South Wales with £58,225,000, Canada with £51,288,000 (net), Victoria with £47,937,300, New Zealand with £39,635,000, Queensland with £30,639,500, Cape Colony with £27,675,178, and South Australia with £23,100,000. St. Helena brings up the rear with a modest £5,408.—Pall Mall Gazette.

Note on the Preparation of Phosphorescent Barium Sulphide.

In some recent experiments with phosphorographic plates the writer had occasion to use some pure barium sulphide. As this could not at the time be obtained from any of the Chicago firms dealing in chemicals, I decided to prepare it for myself.

Solutions of pure barium sulphide ($Ba Cl_2$) and sodium hydrate (Na(OH) were mixed in molecular proportions so as to obtain barium hydrate ($Ba(OH)_2$) and sodium chloride (Na Cl). Hydrogen sulphide gas, prepared and washed in the usual manner, was then passed through the concentrated solution, throwing down the barium sulphide as a flocculent sparingly soluble precipitate, leaving only sodium chloride in solution. The complete reaction is

$$Ba Cl_2 + 2 Na (OH) + H_2S = Ba S + 2Na Cl + 2H_2O.$$

The precipitate was collected on a filter, sparingly washed with cold water, and thoroughly dried in a steam bath. Although barium sulphide is, as is well known, ordinarily strongly phosphorescent, it showed, when prepared in this way, only the faintest traces of phosphorescence even after exposure to bright sunlight for several hours. Somewhat nonplussed by this discovery, of which I could find no mention in any of the works on chemistry which I consulted, I determined to try some of the same material prepared in the ordinary way (by fusing together barium carbonate and sulphur). This, although not as strongly luminous as the powdered blende (perhaps because of impurities), was fairly satisfactory. It then occurred to me that the phosphorescent property might be due to the action of the high heat employed in the dry process of preparation, and that the precipitated material might similarly be rendered luminous by heating. An experiment with a small fragment of the dried precipitate, which was placed in a small porcelain crucible and heated over a gas blowpipe, showed this to be the case.

The power of phosphorescing depended to some degree on the degree of heat applied and the length of the heating.

These experiments are of interest as indicating that barium sulphide may exist in two molecular states, chemically identical but physically different. It will be interesting to determine whether this change is accompanied by corresponding changes in other physical properties, as in the case of fluorspar, lepidolite, and some other substances which become phosphorescent when only moderately heated.

As soon as time permits, further experiments will be made on this and other interesting questions which have presented themselves.—F. L. O. Wadsworth, in the Astrophysical Journal.

Air in the London Underground Railway.

The analysis showed that the amount of oxygen in some air taken between Gower Street and King's Cross [London] was only 20·60 per 100 parts by volume, while in the worst courts of London it was never found lower than 20·86, says Health News. Pure air contains 20·94 per cent of oxygen. And with diminution of oxygen there was a proportionate increase of carbonic acid gas. The normal quantity is 0·037 in 100 parts, but Dr. Angus Smith (whose analysis we are quoting) found that in one of the Metropolitan Railway tunnels the carbonic acid gas was 0·388 per cent; this is excessively high when we take into consideration Prof. Pettenkoper's assertion that whenever the carbonic gas in the atmosphere exceeds 0·100 per cent the air is too much polluted to be breathed with safety to health.

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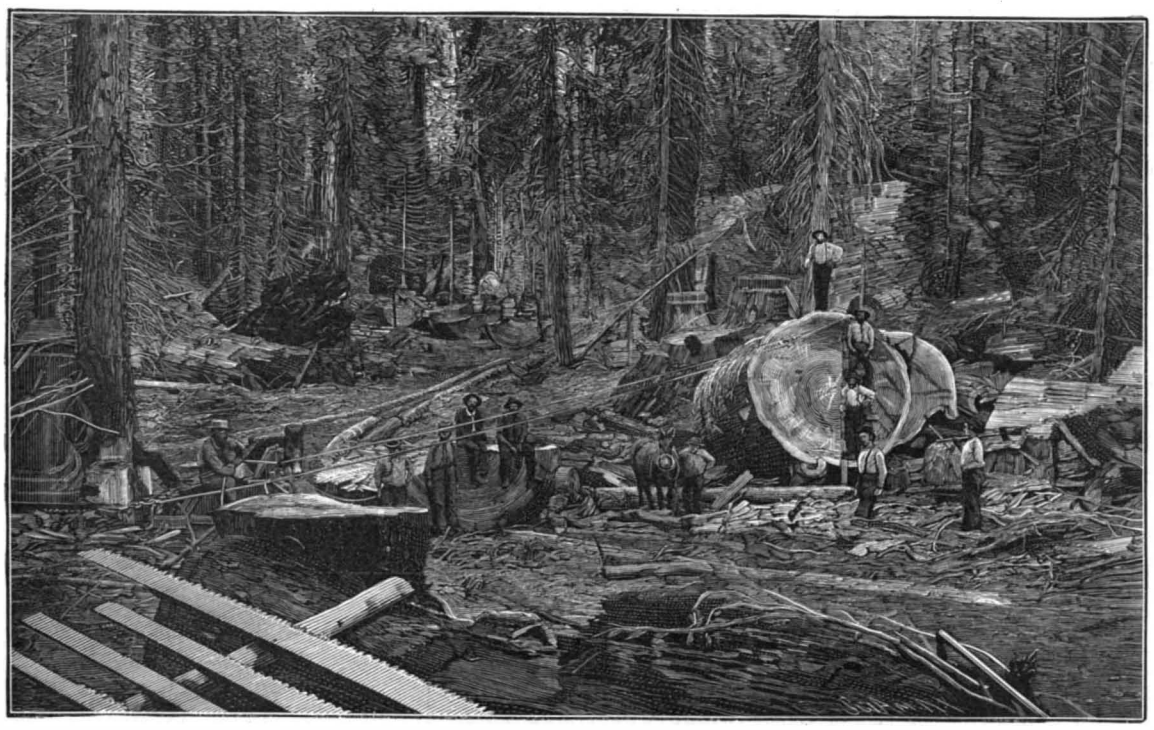
LOGGING IN THE SIERRA NEVADA MOUNTAINS, CALIFORNIA.

Notable among the many natural wonders of western America are the forests of giant trees which cover the lower slopes of the Rocky, the Sierra Nevada and the Cascade Mountains. To an eastern traveler there is no feature of the country lying between the Pacific Ocean and the first named range which creates so strong an impression of novelty as the size and character of the forest timber. The oak, the maple, the elm and a dozen other varieties which are familiar to residents in the country east of the Alleghanies cease to form a feature of the landscape; and as the train climbs the eastern slopes of the Great Divide, he catches his first glimpse of the giant trees of the West, the rounded outline and dense foliage of the eastern trees giving place to the tall, tapering, sentinel-like forms of the redwood of California and the pine and fir of Oregon and Washington. The finest specimens are to be found in the large groves, where the trees are massed in close array, their huge trunks from 10 to 25 and 30 feet thick at the butt, rising perfectly plumb, and without a limb, for from 175 to 250 feet, to the first branches, many of which are thick enough to form a massive tree in themselves. The largest specimens of the California trees are found in the famous groves of Mariposa and Calaveras, where specimens of the Sequoia gigantea, with a diameter of 30 feet at the butt, were not uncommon when the grove was first discovered, and the heights were estimated at from 275 to 400 feet.

The accompanying views were taken at the logging camp of the Sanger Lumber Company, situated on the western slope of the Sierra Nevada Mountains, in Fresno County, California. The two mills are situated at an elevation of 5,000 feet above sea level, and the busy whirr of the band saw, which is used in preference to two circular saws cutting from above and from below, is heard day and night continuously, the night work being carried on by electric light. The mills cut about 225,000 feet in 23 hours. After the lumber is cut it is carried down to the valley, a distance of 54 miles, by gravity. For this purpose a V-shaped flume is constructed, into which a stream of water is directed at the mills, the lumber being swept down by the water at a great velocity. When the timber had all been cut off in the vicinity of the mills, it was necessary to go up to a higher belt—for which purpose some nine miles of mountain railroad were built. After skirting the base of the higher range for five miles, the road is carried up the side of the mountains on a grade of 30 per cent, or 1,584 feet to the mile. A powerful hoisting plant is situated at the top of this grade, and trains of three cars are drawn up at a time with a 1½ inch wire cable.

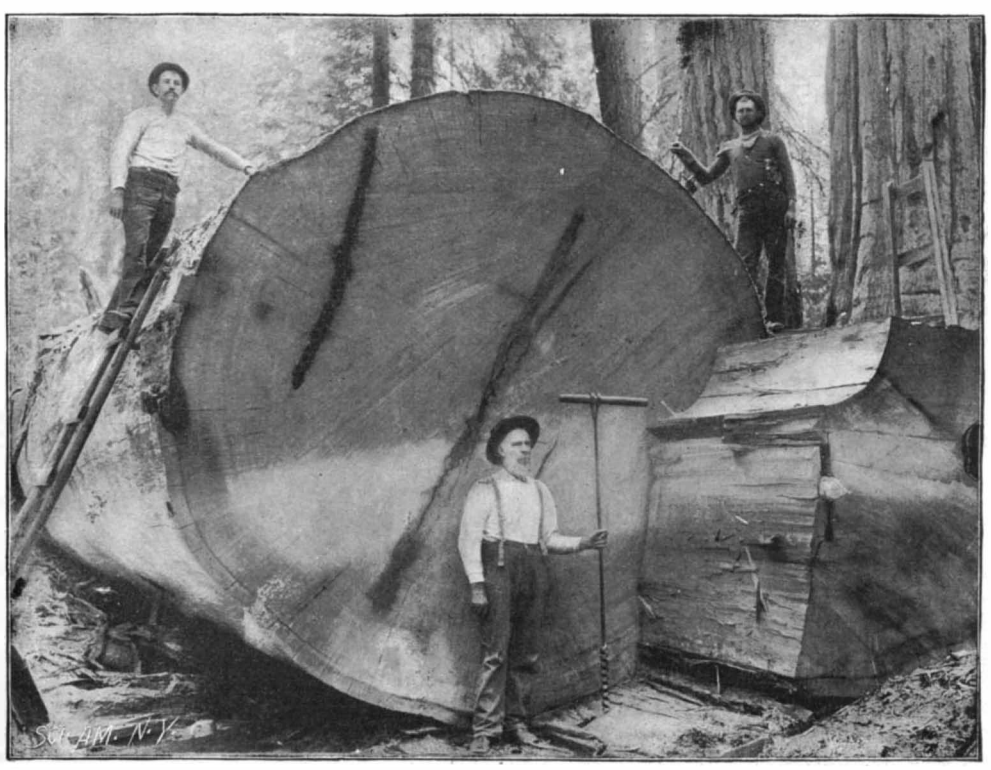


LOGGING IN THE SIERRA NEVADAS—GENERAL VIEW OF CAMP.

After communication with a belt of timber has been established, these noble trees, many of which have been standing over a thousand years, begin to fall beneath the ax and the cross-cut saw. A deep cut is made on the side of the tree toward which it is to fall (as can be seen to the left in the accompanying cut showing the donkey engine), and the tree is then sawn through from the opposite side. The "falling" of a 250 foot tree is a thrilling sight, never to be forgotten. The first warning is given by the cracking of the fibers, as the saw cuts away the small remaining wood that holds the tree up. The top of the tree is seen to move slowly across the clouds, and the giant bends slowly to its fall. With an angry "swish" and an increasing momentum it describes a giant quarter circle to the ground, its two or three hundred tons of weight making the earth tremble as from an earthquake shock. The logs, as will be seen from the illustration, are of unusual size, the majority of them running from 5 to 16 feet in diameter. For convenience of handling, all of the logs over 8 feet in diameter are blasted into sections with powder, before they are shipped down to the mills. The logs are hauled to the railroad by means of a portable donkey engine, which is bolted to a sled. When it is desired to move the sled the wire cable is run through a pulley, which is attached to a convenient tree or stump, and brought back and fastened to the sled. By winding in the cable the engine is drawn into the desired position.

When the logs are to be moved the sled is chained to a tree, as shown, and the hauling is accomplished by running the steel rope through as many steel pulleys as may be required. The logs are hauled to the railroad over chutes formed of two parallel lines of logs or poles, half sunk in the ground, and freely greased with tallow. The hauling on the steel railroad is done by the curious type of locomotive shown in the illustration, which has been designed to give a maximum adhesion for climbing heavy grades. The cylinders, of which there are three, are arranged vertically on one side of the boiler. The crank shaft extends the full length of the locomotive, and drives the four wheels of the truck by means of bevel gears. To provide for the vertical and lateral movement of the trucks, the shafting is provided with universal joints, which are located between the cranks and the trucks. The whole of the weight of the engine is thus on the drivers, and by gearing down a large tractive effort is secured with a comparatively small locomotive.

LOGGING IN THE SIERRA NEVADAS—PORTABLE DONKEY ENGINE HAULING LOGS.



LOGGING IN THE SIERRA NEVADAS—A TWELVE FOOT LOG.

Japan's Merchant Marine.

The annual report of the Japanese Bureau of Merchant Marine, which has just been received here, shows a condition of affairs with respect to the marine of that nation compared with that of the United States which is not flattering to this country. The report shows that Japan has registered for foreign trade 109 iron and steel steamships of 231,139 gross tons. The United States has registered for foreign trade 103 vessels of the same kind, of 226,503 gross tons. The Japanese merchant fleet includes 114 vessels of over 1,000 tons, chiefly steamers of British or German build. The American merchant fleet in the Pacific numbers 119 vessels of this size. The Tosa, the largest of Japanese merchant steel steamships, measures 5,789 gross tons, and was built in England in 1892. The largest American steamship on the Pacific, the City of Peking, measures 5,080 gross tons and was built in 1874 on the Delaware. The largest steel steamship built in Japan is the Suma, of 1,502 tons, built at Nagasaki in 1895.

The Nippon Yusen Kaisha, the chief Japanese steamship line, which has recently made Seattle one of its terminal ports, owns fifty-one steamers of 94,000 tons. The Pacific Mail Line employs fifteen steamers of 43,000 tons on the Pacific. Since 1890 twenty shipyards have been established in Japan and forty were established in the previous decade. Of the ten remaining yards the oldest dates back to 1659. The stone drydock at Nagasaki is 438 feet long and 26 feet draught. The Newport News drydock is 609 feet long and 26 feet draught. The Cramp basin dock is 428 feet long and 21 feet draught.

The Japanese subsidy law, which went into effect in October, gives to shipbuilders a bounty of $10 per gross ton on steel vessels over 1,000 tons, and $2.50 per horse power.

Prize Monographs on Kites.

It is announced that in view of the fact that a number of monographs on kites have been received in competition for the Chanute prize of $100 offered through the Boston Aeronautical Society, since a circular announcing the postponement of the award was issued, the society has decided to limit the time for receiving monographs to January 1, 1897. The award will be made as soon after that as possible.

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Surgery Without Anæsthetics.

One of the most interesting papers read at the recent celebration in Boston of the fiftieth anniversary of the first administration of ether in a surgical operation was that by Dr. John Ashhurst, of Philadelphia, on "Surgery Before the Days of Anæsthetics." It vividly recalls the horrors of those days when the surgeon's knife was an object of far greater terror than now, and inflicted untold tortures upon the conscious patient

"A study of the condition of surgery before the days of anæsthesia," said Dr. Ashhurst, "reveals on the one hand a picture of heroic boldness and masterly self-control on the part of the surgeon, and on the other a ghastly panorama, sometimes of stoic fortitude and endurance, sometimes of abject terror and humiliation—but always of agonizing wretchedness and pain—on the part of the unhappy victim who required the surgeon's aid.

"The 'pitilessness' which Celcus urged as an essential trait in the operative surgeon was, before the days of anæsthesia, a feature in the surgeon's career which impressed very strongly the public generally as well as those immediately connected with the operation. It is interesting to recall that Sir James Simpson, of Edinburgh, shortly after beginning his professional studies, was so affected by 'seeing the terrible agony of a poor Highland woman under amputation of the breast,' that he resolved to abandon a medical career and seek other occupation; happily his intention was reconsidered, and he returned to his studies, asking himself 'Can anything be done to make operations less painful?' and, as every one knows, in less than twenty years became a high priest of anæsthesia, and the introducer into surgical and obstetrical practice of ether's great rival, chloroform.

"No braver or more gallant gentleman ever lived than Admiral Viscount Nelson, and after his right elbow had been shattered by a French bullet in the assault at Teneriffe he manifested the utmost courage, refusing to be taken to the nearest ship lest the sight of his injury should alarm the wife of a fellow officer whose own fate was uncertain, and when his own ship was reached he climbed up its side without assistance, saying: 'Tell the surgeon to make haste and get his instruments. I know I must lose my right arm, so the sooner it is off the better.' 'He underwent the amputation,' we learn from a private letter of one of his midshipmen, 'with the same firmness and courage that have always marked his character.' And yet so painfully was he affected by the coldness of the operator's knife that when next going into action at the famous battle of the Nile he gave standing orders to his surgeons that hot water should always be kept in readiness during an engagement, so that if another operation should be required he might at least have the poor comfort of being cut with warm instruments.

"On the side of the surgeon we find throughout the ages a constant effort to diminish the terrors of operations and a continuous reprobation of the distressful, not to say cruel, modes of practice adopted by preceding generations. And yet the time is not very far distant from ours when they lopped off a limb by striking it violently with a heavy knife; that time when they knew neither how to stop nor how to prevent hemorrhage but by burning the part whence the blood jetted with boiling oil or the red hot iron; that time when surgeons armed themselves at every moment with pincers, with burning cauteries and with instruments, the representations even of which cause terror.

"The belief that operations might be rendered painless appears to have been present in the minds of surgeons from the earliest periods. Witness the accounts of the Memphis stone, described by Dioscorides and Pliny, which by steeping in vinegar was made to give forth the fumes of carbonic acid; and of the mandragora, employed, according to Theodoric, when mixed with other narcotics, by inhalation, and causing a sleep from which the patient could only be aroused by the fumes of vinegar. So profound was the stupor induced by this drug that Bodin assures us that under its influence a man submitted without consciousness to a painful operation and continued to sleep for several days thereafter.

"Vigo speaks of the whole body being 'brought asleep by the smelling of a sponge wherein opium is,' but warns his readers that the practice is dangerous, because the use of opium is sometmes followed by gangrene. In his work on 'Natural Magic,' Baptista Porta speaks of a volatile drug kept in leaden vessels, which produced sleep when applied to the nostrils, and Perrin suggested that this may actually have been ether or some other of our modern anæsthetic agents.

"Mental preoccupation was sometimes sought as a means of preventing pain. Richard Wiseman found that soldiers dreaded the loss of a limb much less if it were removed immediately, while they were 'in the heat of the fight,' than if the operation were postponed until the next day; 'wherefore,' he says, 'cut it off quickly, while the soldier is heated and in mettle;' and Renauldin recalls the case of the amiable Dolomieu, who, exposed to the pangs of starvation in a Neapolitan dungeon, measurably alleviated his own distress by engaging in the composition of a treatise on mineralogy; while his unfortunate servant and fellow prisoner, who had not the same intellectual resources, was hungry enough for both.

"But the presence of pain was not the only evil dreaded by our predecessors in attempting important operations; the great risk of fatal accident from some involuntary movement of the patient was constantly present to the mind of the conscientious surgeon. 'How often,' says Dr. Valentine Mott, 'when operating in some deep, dark wound, along the course of some great vein, with thin walls alternately distended and flaccid with vital current—how often have I dreaded that some unfortunate struggle of the patient would deviate the knife a little from its proper course, and that I, who fain would be the deliverer, should involuntarily become the executioner, seeing my patient perish in my hands by the most appalling form of death! Had he been insensible I should have felt no alarm.'

"Coming down to the days more immediately preceding the date of the great discovery, we find that opium and alcohol were the only agents which continued to be regarded as of practical value in diminishing the pain of operations, though the attendant disadvantages of their employment were, of course, recognized. Meanwhile, facts were accumulating, the significance of which we now plainly recognize, but which excited no attention.

"Sir Humphry Davy, in the early days of the nineteenth century, suggested the use of nitrous oxide gas as an anæsthetic in minor operations, and it was the custom of some of our medical schools—at the University of Pennsylvania, for one—for students to breathe 'laughing gas,' as it was then called, for diversion. But yet—and yet—surgeons went on, in every country, cutting and burning, and patients went on writhing and screaming, until the 16th day of October, in the year 1846, in the Massachusetts General Hospital, Dr. John C. Warren painlessly removed a tumor from a man who had been previously etherized by Dr. William T. G. Morton, and surgical anæsthesia became the priceless heritage of the civilized world."

LOGGING IN THE SIERRA NEVADAS—A THREE CYLINDERED MOUNTAIN LOCOMOTIVE.

Captain Deasy's Expedition to Thibet.

Captain H. H. P. Deasy, of the Sixteenth Queen's Lancers, left England some time ago for a journey across Thibet from west to east, says the London Times. He intends on the way to throw soldered-up tins containing parchment notices in English and French into the tributaries of the Tsanpo and into the other large rivers which he may meet with, in the hope that some of them may be picked up far down stream, possibly in the Brahmaputra, Salween, and Mekong, and thus help to solve the vexed problem of the origin and connections of these rivers. The notices will be consecutively numbered, and the tins in which they will be inclosed will have a brass label soldered on the outside, bearing the words "Please open this" in English and French, and Captain Deasy's name. The parchment inside bears the request that it be forwarded without delay to the Royal Geographical Society, London, with as accurate a statement as possible as to where it was picked up. Captain Deasy is trying to render an important service to geographical knowledge, and it is hoped that the officials, English and French, in the neighborhood of the rivers alluded to may be able to arrange for a lookout, so that the tins may be secured and the parchment delivered to the proper quarter.

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Power in Woodworking.

Prof. O. G. Dodge recently made a series of tests in the Navy Yard at Washington to determine the power required by wood working machinery. The work done is the heaviest that will be required of these particular machines:

Circular ripsaw, 28 inches diameter; speed, 1,200 revolutions per minute, or 8,800 lineal feet per minute. Arbor pulley 5¼ inches diameter by 8½ inch face; hand feed; motor belted to saw shaft: Motor and saw, idle, 3·4 e. h. p.; ripping seasoned heart oak, 7⅝ inches thick, feed 10 feet per minute, 19·3 e. h. p.

Circular ripsaw, 24 inches diameter; speed, 1,500 revolutions per minute, or 9,429 lineal feet per minute; hand feed; motor belted direct to 7 inch pulley on saw shaft: Motor driving saw, idle, 3·2 e. h. p.; ripping seasoned heart oak, 6 inches thick, 10 feet per minute, 12·8 e. h. p.; ripping seasoned white pine, 6½ inches thick, 15 feet per minute, 9·4 e. h. p.; ripping seasoned yellow pine, 2 inches thick, 45 feet per minute, 10·7 e. h. p.

Circular ripsaw, 14 inches diameter; speed, 2,200 revolutions per minute, or 8,067 lineal feet per minute; arbor pulley, 3 inches diameter, 5 inch face; hand feed; motor belted to saw shaft: Motor, idle, 0·96 e. h. p.; motor and saw, idle, 2·7 e. h. p.; ripping seasoned heart oak, 3½ inches thick, 12 feet per minute, 6·3 e. h. p.

Circular ripsaw, 12 inches diameter; speed, 2,200 revolutions per minute, or 6,914 lineal feet per minute; hand feed; belt pulley 3½ inches diameter and 3 inch face; motor belted direct to 3½ inch pulley on saw shaft; saw set to wabble for cutting grooves: Motor, idle, 0·96 e. h. p.; driving saw idle, 2·2 e. h. p.; cutting groove in seasoned walnut, ⅜×⅞ inch, 12 feet per minute, 3·6 e. h. p.

Bandsaw, pulleys 72 inches diameter; speed, 160 revolutions per minute, or 3,017 lineal feet per minute; belt pulley 30 inches diameter, 8 inch face; power feed; motor belted to saw shaft: Motor and saw, idle, 12·1 e. h. p.; ripping seasoned ash 10¾ inches thick, feed 6 feet per minute, 16·1 e. h. p.; ripping seasoned white pine, 16½ inches thick, feed 10 feet per minute, 16·1 e. h. p.; ripping yellow pine, 12 inches thick, 20 feet per minute, 18·8 e. h. p.

Bandsaw, pulleys 42 inches diameter; speed, 350 revolutions per minute, or 3,850 lineal feet per minute; belt pulley 16 inches diameter, 5 inch face; hand feed; motor belted to saw shaft: Motor, idle, 0·96 e. h. p.; motor and saw, idle, 2·9 e. h. p.; ripping seasoned oak, 12 inches thick, feed 3 feet per minute, 5·7 e. h. p.; cross cutting seasoned oak, 8 inches thick, feed 5 feet per minute, 5·7 e. h. p.; ripping live oak, 10 inches thick, feed 3·2 feet per minute, 5·7 e. h. p.

Bandsaw, pulleys 28 inches diameter; speed, 480 revolutions per minute, or 3,520 lineal feet per minute; belt pulley 12 inches diameter, 3½ inch face; hand feed; motor belted to saw shaft: Motor, idle, 0·96 e. h. p.; motor and saw, idle, 1·7 e. h. p.; ripping seasoned oak, 3 inches thick, feed 2½ feet per minute, 2·3 e. h. p.; ripping seasoned pine, 3 inches thick, feed 4 feet per minute, 2·3 e. h. p.; cross cut seasoned oak, 3¼ inches thick, feed 4 feet per minute, 2·3 e. h. p.

Daniel's planer, machine bed 2 feet 5 inches by 21 feet 6 inches; belt pulley, 13 inches diameter by 5¼ inch face; speed, 350 revolutions per minute; speed of cutting edges of tool, 10,400 feet per minute; power feed, 12 feet per minute; motor belted to countershaft: Motor, idle, 0·96 e. h. p.; driving machine, idle, 3·9 e. h. p.; planing seasoned oak, cut $\frac{3}{16}$ inch deep by 20 inches wide, 12 feet per minute, 6·2 e. h. p.

Hand cylinder planer or jointer, size of machine, 24 inches; belt pulley, 4 inches diameter, 5 inch face; speed, 3,200 revolutions per minute; speed of cutting edge of tool, 4,000 feet per minute; hand feed; motor belted to shaft of tool: Motor, idle, 0·96 e. h. p.; driving machine, idle, 2·40 e. h. p.; planing white pine, cut 0·11 inch deep by 18 inches wide, 25 feet per minute, 4·80 e. h. p.

Cylinder planer, size of machine, 24 inches; belt pulley, 5 inches diameter, 5 inch face; 2,250 revolutions per minute; speed of cutting edges of tool, 3,105 feet per minute; power feed; motor belted to shaft of tool: Motor, idle, 0·96 e. h. p.; driving machine, idle, 2·40 e. h. p.; planing pine, cut $\frac{1}{16}$ inch deep, 18 inches wide, 11 feet per minute, 3·6 e. h. p.; planing oak, cut $\frac{1}{16}$ inch deep, 6½ inches wide, 11 feet per minute, 3·6 e. h. p.

Boring machine, speed of bit, 375 revolutions per minute; hand feed; motor belted to bit shaft; Motor, idle, 0·96 e. h. p.; driving machine, idle, 1·7 e. h. p.; boring 4 inch hole in seasoned oak, $9\frac{3}{5}$ feet per minute, 2·3 e. h. p.

Boring machine, belt pulley 8 inches diameter, 3 inch face; speed, 750 revolutions per minute; hand feed; motor belted to machine shaft: Motor, idle, 0·96 e. h. p.; driving machine, idle, 1·9 e. h. p.; boring 1 inch hole in oak, feed 3¾ inches in 5 seconds, 2·2 e. h. p.; boring 1⅝ inch hole in oak, feed 1 inch in 7 seconds, 2·2 e. h. p.

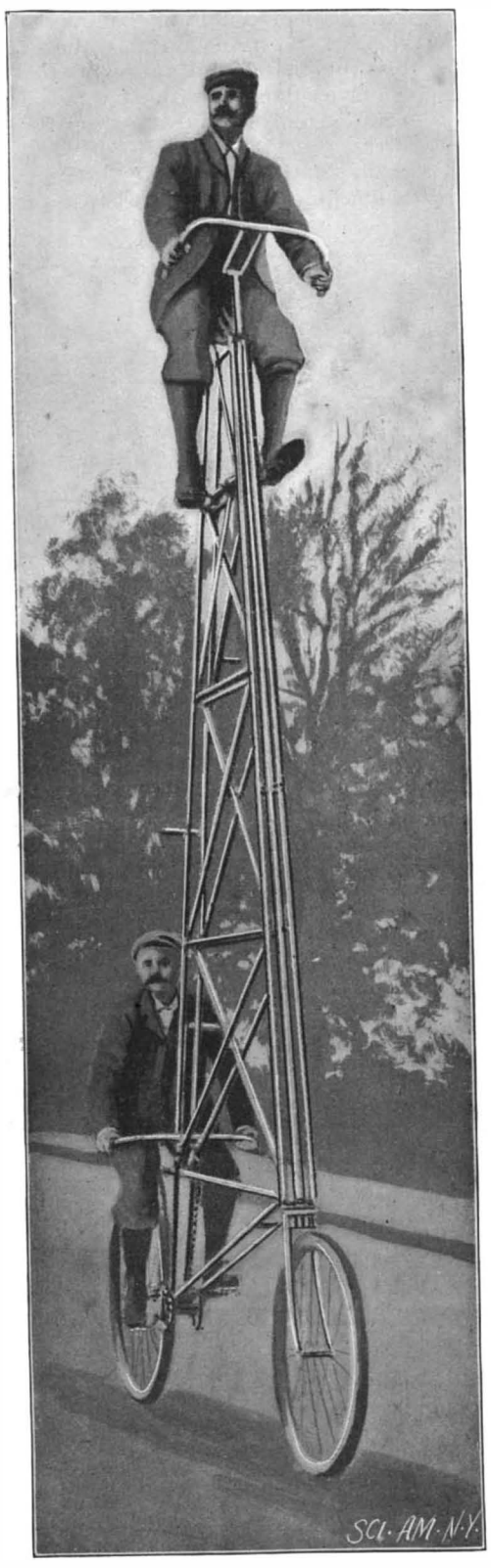
Pattern maker's lathe, speed 888 revolutions per minute; motor belted direct to lathe: Motor, idle, 0·96 e. h. p.; driving lathe, idle, 2 e. h. p.; turning seasoned poplar, 12 inches diameter, ½ inch cut, 3·2 e. h. p.

Carver and moulder, speed of tool, 5,236 revolutions per minute; motor belted direct to tool shaft: Motor, idle, 0·96 e. h. p.; driving tool, idle, 2·8 e. h. p.; cutting groove, circular sector, 2 inches wide, ¾ inch deep, 3½ feet per minute, in white pine, 3·9 e. h. p.—American Woodworker.

THE EIFFEL TANDEM.

Besides the bicycles, tricycles, etc., which are intended purely for sport, there are several noteworthy machines that make a practical application of the chief advantage of the cycle—its speed. These machines now serve various purposes in practical life, among which might be mentioned those used in the army, the quadricycle of the fire department, etc., the usefulness of which has been proved.

Now a new construction in the form of a tandem makes its appearance in America. It is called the Eiffel tandem and is a real curiosity. As will be seen in the accompanying engraving, the lower part of this gro-



THE EIFFEL TANDEM.

tesque vehicle—the oddity of which cannot be fully appreciated from the cut—consists of a strong bicycle, on which is built a frame of hollow iron rods that is about 20 feet high. On the top of this frame is a saddle with handle bars and treadles, the motion of which is transmitted by chains to the corresponding lower parts of the bicycle. The chief difficulty with which the riders have to contend is to keep the machine balanced, as will be easily understood from a glance at the illustration, but it must also be very difficult for the upper rider to reach his seat, which cannot be a very safe one. It is not easy to guess the use for which this strange machine is intended, but it would seem that the rider must be placed in this elevated position to enable him to reconnoiter the ground. We are indebted to Der Stein der Weisen for the above particulars.

IN the Pabst brewery, at Milwaukee, is a machine which corks, wires and caps 16,000 bottles per day automatically.

Science Notes.

Dr. Nansen is to deliver an address at the meeting of the Royal Geographical Society on February 8 next, and as he is already a gold medalist of the society, a special medal will be presented to him, an honor which was also conferred on Mr. H. M. Stanley, M.P.

Turin is going to hold an Italian exhibition in 1898. It will include the work of Italians abroad and of the Catholic missions. There will also be an international exhibition of electric appliances and of machinery. Among the special features will be athletic games and a review of comic art.

The Pharmaceutische Zeitung publishes analyses of the principal commercial brands of saccharin, says the Pharmaceutical Era:

100 parts of saccharin.	v. Heyden.	Fahlberg.	Bayer.	Monnet.
Moisture..... ...	0·28	0·26	0·19	0·05
Ash..	0·098	0·06	1·63	0·04
Para compound.....	0·00	0·37	0·00	0·00
Saccharin (true).....	99·82	99·31	98·18	99·91

Another small planet has been detected on a photographic plate taken by Herr G. Witt, of the Urania Observatory, Berlin, October 8. It was observed the following evening with the 12 inch refractor, and, if all the recent discoveries are verified, will reckon as No. 424. The small planet, No. 324, discovered by Dr. J. Palisa on February 25, 1892, has been named Bamberga, to commemorate the meeting of the German Astronomical Society at Bamberg.

M. E. Villari recently contributed to the Paris Academy of Sciences some observations on the property of discharging electrified conductors, produced in gases by the X rays and by electric sparks. It was shown that a gas confined in a tube, and exposed to the X rays acquires rapidly the power of discharging an electrified disk, and keeps this property for some time. The passage of a series of sparks from a coil strengthened by a condenser confers the same property on a gas, says Nature.

Prof. D. G. Elliot, the leader of the Field Columbian Museum of Chicago Expedition, has arrived home. Speaking of the results of his expedition into Somaliland, Prof. Elliot said: "I have obtained a very extensive collection, chiefly of the large mammals—probably the most complete ever brought out of any country by one party. No fewer than fifty-eight cases and barrels were shipped direct from Aden to Chicago. I obtained, moreover, over 300 specimens of birds, fish, insects and reptiles."

C. E. Stromeyer describes in Nature a method by which he was able to make mercury float on water. A few drops of mercury, half an ounce of water and a pinch of red lead, red oxide, vermilion or other red powder were shaken together in a small cylindrical bottle. A few small globules of mercury were then found floating together at the center of the water surface. By repeated shaking a small dish—about three-eighths inch in diameter and one-sixteenth inch deep—was formed, consisting of a large number of mercury globules, and this floated on the water in the same position. The dish did not disappear if allowed to rest, and always reformed after shaking the bottle.

Almer the Swiss mountain guide's seventieth birthday has just been celebrated at Grindelwald. He is the hero of over two hundred first ascents, including the Wetterhorn, the Schreckhorn, the Eiger and the Moench on the Wengern Alp. It is said that he is the only man that ever came down alive from the last peak. He has repeatedly climbed the Jungfrau, and all the peaks of the Oberland, the Valais, the Grisons, and of Savoy. The tops of some of the Aiguilles of Mont Blanc and of the dolomites of Dauphine he alone has reached. He has five sons, all well-known guides, who have been employed in climbs in the Caucasus and the Himalayas. His career ended ten years ago, when he lost all his toes during an ascent of the Jungfrau, in January.

Herr Friedrich Benesch contributes to the Mittheilungen der K. K. Geographischen Gesellschaft in Wien, says Nature, a short description of Pauliny's new method of drawing relief maps, which he says is a great advance on any method now in use, both in respect of accuracy and of ease in execution. The map is in effect a closely contoured map, printed on silver gray paper, the contour lines being white where illuminated by a source of light supposed to be 45° above the western horizon, and black elsewhere. Level plateaus and slightly sloping areas are thus represented by the natural gray color of the paper; steep declivities toward the west are lightened by the closely drawn white lines, and toward the east correspondingly darkened by the black lines, the departure from the normal gray being greater the closer the lines, i. e., the steeper the slope. The method has the merit of giving a clear idea of steepness derived from the contour lines themselves; and while it does not demand the high standard of skill necessary in Lehmann's method of hatching, the confusion produced by the shadows in some modern maps, where the illumination is supposed to come from the horizon, is avoided. Maps illustrating Herr Pauliny's method are to be published in Vienna in the course of the summer.

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The Value of India Rubber.

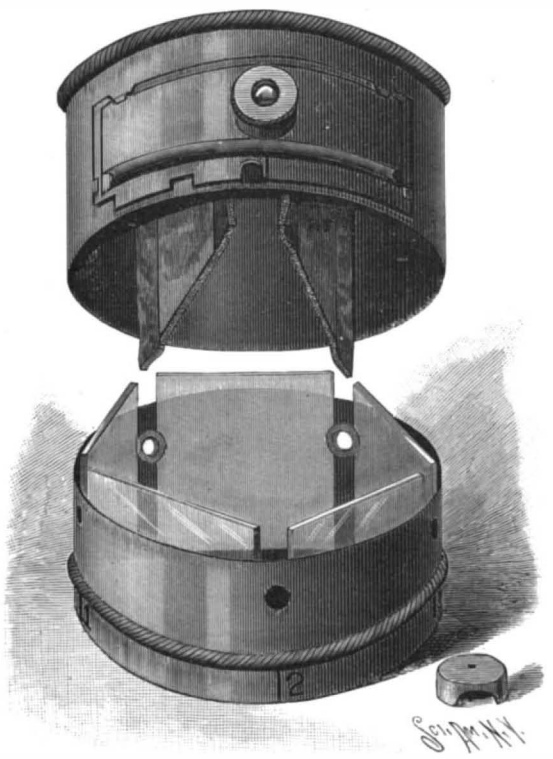
India rubber is in a fair way to become one of the prime necessities of civilization. Numberless human beings, in the class which could not afford wet nurses, owe their lives to the feeding bottle. Everybody knows that in the last five years the use of pneumatic tires for cycles and solid rubber tires for horse vehicles has enormously increased our consumption of this article; but, quite apart from that more obvious fact, India rubber is daily being introduced more and more into all sorts of machinery. Highly competent judges say that if the output could be doubled within a year, so many new applications of the material would instantly arise, that the price would not fall appreciably. As a matter of fact, the export of Para rubber has increased within the last twenty-five years from 5,600 tons to 20,000 tons; and the price fetched by the best quality has risen from 2s. to 3s. a pound. It is the one jungle product which society finds indispensable. Hundreds of men have racked their brains to produce a substitute, but none has in the least degree succeeded; and such attempts must be permanently discouraged by the knowledge that India rubber exists in limitless profusion upon known spots of the world's surface which may at any time be made accessible. In any of the swampy equatorial regions, where vegetation grows rank and sappy, so that a knife will slash through branches as if they were made of cheese, there is pretty certain to occur some one or two of the score of trees which produce rubber. Whole forests of them are known to exist in Central Africa, only waiting to be tapped. But the regions which produce them are precisely the regions most deadly to the white man; and when the rubber is made it has to come to the coast on the heads of negroes, and will not pay the cost of transport. When an accessible forest is discovered it pays like a gold mine. A tree was discovered near Lagos which was believed to produce rubber; specimens of bark and foliage went home to Kew, and the authorities pronounced it the right thing. In 1895 the export began, and amounted in the year to 2,263 tons, with a value of £270,000 in round figures.

India rubber would seem to be the one certain source of wealth now locked up in Central Africa, and perhaps the most valuable thing that the region produces or can produce. Ivory is only a fancy article, and palm oil has many substitutes. Gold no doubt exists there, but, in the first place, it is doubtful whether the pure negro can be made into a miner; and in the second, gold is to be got in regions where white men can live. It seems, therefore, as if the special function of the tropics just now was to produce India rubber, which is wanted everywhere and cannot be grown elsewhere. No cultivation is needed; Nature requires of man very little skill, scarcely any exertion, and only a reasonable avoidance of waste. Yet this is asking more than the African negro is at present able to give. The great rubber producing region of the world is the basin of the Amazon, which yields about two-thirds of the entire annual output. The quality of this rubber is immensely superior to all others; the best Para will fetch in England as much as 3s. 6d. a pound; the worst African goes for under a shilling. Brazil has, of course, an immense advantage in its great waterway; ocean going steamers run twelve hundred miles up the Amazon, whereas every African river, except the Congo, has a bar at its mouth, and cataracts not far distant from the coast line. On the other hand, the forests in Brazil seem even more impenetrable than in Africa. Not even such roadways as the African man paths can be maintained against the encroachment of the jungle. But the native Brazilian race is incomparably more intelligent than the negro. Their caoutchouc is better prepared, and, what is far more important, they farm the trees as carefully as the Red Indians used to farm the beaver. In Africa the rubber is generally produced, not from a forest tree, as in Brazil, but from the landolphia, which is a climbing shrub. The supply of rubber producing plants in Central Africa is practically inexhaustible, but the number of places where they exist within easy distance of some export station is small, so far as our present knowledge goes. Yet for the present, speculators will probably hasten to be rich, and if they hit upon a forest, will treat it like a mine, anxious simply to take out the maximum at the minimum of cost.

Whether our state, or any other, will ever make this a great branch of its tropical forestry remains to be seen. The Germans, with their usual thoroughness, have a strong scientific staff at the Cameroons. The English, in their usual makeshift way, content themselves with sending home to Kew for suggestions. But the government of India have at least tried an experiment upon the great scale. No private firm, however wealthy, would embark upon the cultivation of India rubber; the trees take a matter of twenty years before they can produce a pennyworth. In addition to that, cultivation must occupy a huge extent of ground of such a nature that no European can enter it during the rainy season, and where the growth is so thick that twenty men might be tapping trees within a mile of the ranger, and he none the wiser. Nevertheless, the Indian government have a nursery of Para rubber trees in Assam, extending over two hundred square miles, which will in time begin to yield; and if any department can control such a farm, the Indian woods and forests will.—Spectator (London).

A NOVEL CAMERA.

The variety in shape and form of miniature cameras that has taken place in the past two or three years is something remarkable. The simple small camera which is the subject of our illustrations, made in the



MINIATURE HAND CAMERA—TAKEN APART FOR LOADING.

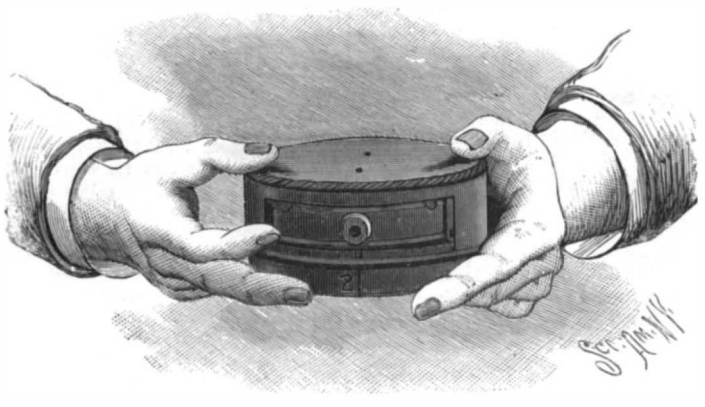
shape of a circular box somewhat smaller than a collar box, is one of the newest forms recently introduced. It is called the "Photake" and is very inexpensive for the amount of work it will do. The camera, as will be seen from the larger engraving, consists of two metal boxes, the upper one sliding over the lower part telescopically.

The lower part is provided with round metal eyes on the interior having lateral annular projecting flanges, between which the plates (two inches square) are inserted. The hole at the center of the eyes allows the light from the lens to pass through between two plates to the rear plate. The plates (five oft hem) are readily inserted and removed in the dark room. At the bottom of the lower half are numbers and vertical marks stamped on the periphery to note the position of the plate.

Underneath the lens aperture in the upper portion is a slight mark under which the figures and mark on the lower half coincide when the lower half is rotated to change the position of a plate.

The upper part contains two diverging light-separating metal divisions having flexible material on the ends which rub slightly against a plate when the lower magazine portion is revolved. On the outside is a miniature lens held in a short tube by an annular screw cap.

To clean the lens at any time, the screw cap may be



MINIATURE BOX CAMERA—EXPOSING.

taken off and the lens dropped or pulled out and be readily polished off with a handkerchief. Behind the lens is a simple spring sliding shutter, following the circle of the box, the release projection will be seen directly under the lens. To set the shutter the finger is placed over the lens, then the release is pushed from the center to the left and slides upward into the notch at the extreme left hand end. The exposure is made as shown in the lower engraving by a slight pressure downward with the index finger of the right hand on the projection. When released, the spring pulls the shutter quickly to the right. To make a time exposure the release projection is pushed upward into the middle notch and the finger removed from the lens. For such exposures it is necessary to use a diaphragm in front of the lens; such a diaphragm cap will be noticed at the right hand corner of the larger engraving. Having quickly loaded the lower magazine portion, and placed over it the upper part, the camera as shown in the smaller picture is ready for operation. An exposure is made, the lower part is next revolved until No. 2 comes in position under the lens, and the process repeated until the five plates have been exposed.

The simplicity of the camera, its compactness, the thorough protection of its working parts, and the facility and certainty with which it may be operated make it especially useful for beginners, or those who know little or nothing about photography.

The Care of Lamps.

In a certain household that I know, says a writer in the Boston Journal of Commerce, the lamps are a source of the greatest delight and comfort, for they are always spotlessly clean and they give a light that could not possibly be better or brighter. The reason for this is that the mistress, instead of depending upon any of her several servants to care for the lamps and clean them, herself bestows upon them the necessary attention. When these receive a thorough cleaning—once every six weeks—the reservoirs and burners are boiled in soda and water and dried before the fire, not on cloths, as these might have lint. The cloths that are used for the daily trimming and dusting are frequently boiled to remove the oil. The shades are polished and the lamps filled every day.

The wicks of lamps will absorb more oil if they are thoroughly dried before putting them in the burners. To prevent the lamp from smoking, soak the wick in vinegar and then dry thoroughly. Occasionally washing and boiling the wicks in soap and water, rinsing and drying thoroughly, is also a good plan. Every day the charred portion should be rubbed off with a piece of paper or cloth, and once a week the edge of the wick should be trimmed with a sharp pair of scissors. The wick will burn with an even flame if it be cut straight across and slightly rounded at the sides. The reservoir of a lamp should be kept well filled, but when not in use the wick should be turned down to keep the oil from oozing up between burner and collar, greasing the outside and causing a disagreeable odor. When a lamp is lighted, however, it is best to keep the wick turned up to its full extent to prevent smoking.

To render lamp chimneys less likely to crack they should be put in cold water, which must be brought to the boiling point, after which they should be allowed to cool slowly without removing from the water. Wash the chimneys in ammonia water and wipe dry on soft towels that are free from lint; polish with tissue or newspaper. Rub brown spots with salt or whiting.

Kerosene has always an unpleasant odor, therefore it is better to use the best astral oil for dining room and parlor lamps. Some housekeepers perfume these oils, but this is altogether unnecessary. Never mix two kinds of oil, for the light from such is bad. To make a lamp burn brightly drop in the reservoir a pinch of salt or camphor.

The Lean Meat Diet for Dyspeptics.

The truth seems to be that a person subsisting upon a lean meat diet, while he may manifest a greater amount of strength than upon more natural dietary, and may be unconscious of any abnormal condition, is like a person in a powder magazine—he is in constant danger of vital catastrophe, says Medical Progress. The poison destroying functions of his liver and the poison eliminating capacity of his kidneys are taxed to their utmost to keep the proportion of ptomaines and leucomaines in the tissues down to a point which permits of the performance of the vital functions. The margin of safety, which nature has wisely made very large in order to provide for emergencies, is reduced to the narrowest possible limit, so that anything which temporarily interferes with the functions of the liver or the kidneys, or which imposes additional work upon them, may be sufficient to obliterate the safety margin and produce an attack of grave or fatal disease. Invasion of the body by ptomaine producing microbes, such as the typhoid bacillus, the bacillus of diphtheria, the pneumococcus of Friedlander, the shocks resulting from accident, and even the depression of a severe cold may be sufficient to consume the meager emergency capital, and the result is acute inflammation of the kidneys, or death under chloroform, or from shock following an operation under anæsthesia.

THE first street tunnel in Germany has been recently opened to traffic at Stuttgart, Wurtemberg. It has a length of 125 meters (410 feet), and the remarkable width of 20½ meters (67 feet). By making the ends of the tunnel funnel-shaped, the necessity of lighting it during the day has been avoided. At night the tunnel is lighted by electricity. The cost was $65,000.—Uhland's Wochenschrift.

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RECENTLY PATENTED INVENTIONS.

Engineering.

WATER TUBE BOILER.—Charles Edgerton, Philadelphia, Pa. This is an improvement in high pressure boilers in which tubes are entered into the flattened side of a cylindrical drum, two sets of water tubes being connected with the drum, one for downward and tbe other for upward circulation. A series of narrow braces is arranged on the inside of the flat portion of the boiler between the tubes, and broad U-shaped braces are arranged in the same relation to the drum, but receiving between flanges the tubes for the downward circulation. The braces are of peculiar shape, are of one piece of metal without seam or weld, and are pressed into shape, their flat surface being very thoroughly stayed without the use of stay bolts. They also serve the purpose of strengthening the drum longitudinally and in all other directions.

BOILER FURNACE.—Dudley D. Fleming, Jersey City, N. J. This furnace is designed to contain many times the volume of fuel now used, and have a reduced grate area, maintaining a slower generation of the gases, by means of a regulated primary air supply and the combination therewith of water vapor. The combustible hydrogen and carbonic oxide gases are subjected to contact in properly constructed combustion chambers with a regulated secondary air supply, converting them into water and carbonic acid gas, a reaction which is continued to the point of escape in the chimney. The furnace is constructed in a series of sections, to be alternately charged or cleaned, always maintaining sufficient heat to ignite the gases in contact with the secondary air supply, or, when bituminous coal is used, to consume the carbon vapor or smoke.

Railway Appliances.

CAR COUPLING.—Thomas Fales, Bridgeport, Cal. This invention relates to couplings of the pin and link type, which may be arranged to automatically couple meeting cars, the uncoupling being effected from the side, so that the trainmen need not go between the cars. The drawhead has a throat above which is a slot provided with link-holding devices, while movable on a vertical axis in a horizontal recess is an arm with one end projecting into the throat to engage the top of the link, the other end of the arm extending outwardly. The common link and pin coupling may be readily changed into one of the improved form, and cars provided with the old couplings may be used together with such as have the improvement.

METALLIC TIE.—John S. Mitchell, Greensborough, Md. This tie comprises two casings, connected by crossed binding rods and a clamp, each casing having an arched or hemispherical top with downwardly extending flange embedded in the ground. Each casing has in its upper surface a man hole through which it may be packed with earth, and in the center of its top is a longitudinal recess to receive a strip of hard rubber on which rests the base of the rail, held in position by clamping plates.

CONTROLLING CAR GATES FROM THE ENGINE.—Seth A. Crone, New York City. According to this improvement one or two lines of pipe connect the platforms of the several cars of a train with the main air reservoir on the locomotive, where there is a valve under the control of the engineer, to enable him to control, by means of suitable devices, the gates on each platform, opening those on one side while the others remain closed. Each of the gates may be readily opened and closed by an attendant on the car. The improvement is designed to be especially advantageous on elevated railroad trains, although it may be applied to all kinds of gates and doors.

Electrical.

BICYCLE ELECTRIC LIGHT.—Francis E. Magee, Brooklyn, N. Y. In a suitable casing, secured to the rear fork of a bicycle frame, according to this improvement, is a generator whose armature is revolved by a band from a grooved wheel on the hub of the rear wheel of the bicycle, the device adding but very little to the weight of the bicycle, and generating a light of normal candle power when the rider is going at only a moderate speed, the generator being connected to a lamp on the front fork. The connections a d windings of the two armature sections are arranged in the same direction, and a simple mechanism is provided whereby the current may be cut off or governed to prevent fluctuations or the burning out of a lamp.

ELECTRIC LAMP.—This is a further invention of the same inventor providing a lamp for traveling vehicles that will produce a strong and brilliant light, and in which the focus may be easily and quickly adjusted. It comprises a metal casing with lens in its forward end, a longitudinally adjustable reflector carrying an incandescent lamp socket, and means for effecting the adjustments and carrying the current to the lamp. All the metal parts are preferably made of aluminum.

ANNUNCIATOR DROP.—William Schwagerman, Yonkers, N. Y. This is a drop which, in its elevated or normal position, will not be discharged from its support when the annunciator is subjected to severe or constant jar or violent agitation, as in its elevated position the drop rests on the heads of the armatures and they form an effective lock. The armature is of the twin type, and so arranged as to automatically pass to locking engagement with the drop when the latter is raised. When the magnet is energized, it attracts the armatures to bring them together and free the drop.

Miscellaneous.

GRAIN ELEVATOR.—James D. Ream and Moses Lewis, Broken Row, Neb. This invention provides a construction designed to relieve the buckets of surplus grain, and to permit of charging the casing with surplus grain without removing the latter from the casing. The elevator has the usual elevating buckets, and there are relief chambers on opposite sides of the grain receiving compartment, each chamber having an inlet and an outlet gate to connect the interior of the chambers with the casing. The sprocket chains are of novel construction, and may be run in either direction without danger of disconnecting the links.

CONFECTIONERY MACHINE.—Simeon J. Hicks, Chicago, Ill. This is a machine more especially designed for forming wafers or patties in a cheap and economical manner. A hopper in the frame of the machine has chambers for the passage of the moulded articles, there being a main shaft journaled above the hopper and plungers movable in the chambers of the hopper, a spring moving the plungers in one direction and cams on the shaft moving them in the other direction. The machine is of simple construction, and arranged to be readily taken apart for cleaning and repairs.

METER.—John H. Dixon, Marietta, Ohio. This invention relates to meters having flexible diaphragms and valves controlling the inflow and outflow of the liquid, and comprises a measuring chamber in which the diaphragm is secured, a valve controlling the inflow and outflow, and a telescoping stem connected with the diaphragm, while a lever pivotally connected with a member of the stem has a spear-shaped end engaged by a spring-pressed arm, there being a connection between the lever and the valve rod. By the up and down movement of the telescoping stem the lever is set in motion to actuate the registering device to indicate the amount of gas or other fluid discharged.

MUSICAL INSTRUMENT.—Henry E. Hibsham, New York City. In auto-harps, this invention provides a system of key-operated levers which normally act to mute the strings. There is a locking device for each series of rows of keys by which, when one or more keys are manipulated to raise certain levers from certain strings, the levers will be held in their upper position automatically until other keys of the same series are pressed, when the levers held raised will be automatically released, and the levers last raised locked in elevated position.

MEANS FOR SOUNDING COMBS.—Alfred Herrling, Jersey City, N. J. In musical instruments using combs to produce the desired tones, this invention provides improved means for sounding the teeth of the combs to produce soft and melodious tones and completely obviate the harsh, metallic sounds caused by picking the combs as heretofore. The instrument comprises a comb, and reeds or like vibrators having felted or cushioned portions arranged to intermittently engage the teeth of the comb, the vibrators being actuated by pressing on a key which opens a valve connected with an opening in the wind chest.

MANIFOLD CASH SALES BOOK.—John H. Murphy, New York City. This book has a flexible back with stiffening strip engaged by side arms, which open to permit the entire back to swing downward for inserting new leaves. The leaves are transversely perforated near the middle, a spring-pressed bar holding the leaves and a transfer sheet in place. The book is designed to enable a salesman to quickly and conveniently write out a duplicate sales slip on a doubled-up leaf and remove it in separate parts from the book, making an entry of each sale.

WASHING MACHINE.—Joseph Lachance, Little Falls, Minn. The body of this machine is in the form of an elongated suds box, within which are rubbing slats extending over the sides, bottom and top, and at one side of the inlet opening is a baron which a wringer may be fastened. The body is pivotally supported on a rack or frame, to which are pivoted oppositely arranged levers, arms of which engage opposite ends of the suds box and are connected with treadles, and by working the levers the body is rocked, moving the clothes in contact with the rubbing slats until the cleansing is effected.

SPRING.—Alexander C. Bell, New Alexandria, Pa. This is an improvement which may be characterized as a "jolt receiver," and is applicable to buggies, carriages, cars, ambulances, bicycles, beds, car and school seats, etc. The invention comprises a support to which the springs proper are held, while a lever having sliding connection with the support has rigid arms extending over the springs, links connected with the lever arms extending through the springs proper. The construction obviates a solid center and furnishes a yielding spring bearing at all points.

PEN OR PENCIL HOLDER.—Edward G. Wickwire, Larned, Kansas. This is a holder adapted to be readily applied to any article of wearing apparel, without injury to the garment. It is made of a single piece of spring wire bent to form an X-shank, a coil at the upper end of each member and pins extending downward at the rear, the wire being also bent at its lower ends into coils. The holder has clamping sections to hold the pen or pencil in upright position, and keepers are provided for the pins, rendering them safety pins.

STAMPING OUT CARTONS, ETC.—Arthur Friedheim, Berlin, Germany. This invention provides a device for making beveled edged photographic mounts and similar articles, the bevel being made at the same time the cards are cut from the sheet. From a plate attached to a vertically moving plunger or die are pivotally suspended a number of knife holders, the knives being arranged diagonally so that the cutters incline outwardly, and cut the material obliquely on the descent of the plunger.

SASH HOLDER.—Charles H. Beer and Charles H. Beer, Jr. (the Charles Manufacturing Company, 317 East 125th Street, New York City). This is a device for preventing the rattling of window sashes, and consists of a spring rod bent at its middle to form a transverse coil, its terminals being adapted to engage the upper and lower sashes of a window, while the coil bears against a portion of the window frame. The device is extremely simple and inexpensive, and operates to push the upper sash outward against the outer bead of the window frame, pushing also the top rail of the inner sash outward against the lower rail of the top sash.

DOOR SECURER AND KEY RING CHAIN.—George F. Bailey, Peabody, Mass. This is a simple device for readily locking a door in closed position or supporting a key ring chain from a trousers button. An oval plate with elongated opening to hook onto a button has at one end a flange adapted to engage the opening of the striker, and to the other end of the plate is attached a chain carrying a key ring a d having at its outer end a hook. When the plate is placed in position and the door closed, the chain is extended around the shank of the door knob, and the hook is made to engage one of its links, preventing the openi g of the door until the hook is disengaged.

TROUSERS PRESSER AND STRETCHER.—Robert B. Colley, St. Heliers, Island of Jersey. This device comprises a pair of presser boards with metal cross bars which enable pressure to be applied by wing nuts screwing on coupling screws hinged to one set of cross bars and engaging slots in the ends of the other set of cross bars. The lower board is a single piece, but the upper board is in three separate portions, two narrow end clamping portions serving to hold the garment stretched and a long intermediate presser portion.

BRUSH CLEANER.—Theodore L. Harlow, Gardner, Mass. This is a device adapted to be placed as a fixture in mucilage bottles, etc., and so shaped that both sides of the brush and one of its vertical edges may be cleaned simultaneously by simply drawing the brush through a portion of the cleaner. The device is preferably made of a single piece of round wire, to fit in a groove at the bottom of the neck of the bottle, and comprises two loops connected by a cross bar, there being downwardly extending parallel cleaning sections at one side of the cross bar and a bowed section in the same plane as the loops.

VENDING DEVICE.—George O. Ranson, Portland, Oregon. This is a device in which the receptacle represents a human face with eye and mouth openings, there being movable eyeballs and detachable teeth, the latter connected with the eyeballs and with packages of merchandise, so that as a tooth is drawn the eyeballs express pain and return to their normal position on the detachment of a package of merchandise, the latter being drawn through the mouth opening. The device is designed to afford amusement to children while making a purchase.

MUCILAGE BOTTLE.—Stephen O. Trescott, Pittsburg, Kansas. This is a bottle designed to discharge the mucilage in such a manner as to dispense with a brush, and may be employed to apply the mucilage with great nicety, either in a narrow line or a broad band. The body of the bottle is of rubber or similar material, and has a wedgelike tip to act as a substitute for a brush, with an outlet for the passage of the mucilage when the body is compressed.

PHOTOGRAPHIC PLATE HOLDER.—Matthias Flammang, Newark, N. J., and Frank Moniot, New York City. This is a holder which enables the operator to accurately adjust the screen relatively to the sensitive plate, according to the nature of the object to be photographed, and comprises a main frame adapted to receive a negative auxiliary frame movable toward and from the negative and having inclined slots, pins sliding in the main frame engaging the slots of the auxiliary frame, and lazy tongs in the latter fra me having holders for a screen plate. The shifting de vices for the screen plate extend through the frame to the outside.

NECK STRAP FOR HORSES.—Reuben F. Newman, Manasquan, N. J. This is a strap having a portion to extend around the neck of a horse, with a leader or hitching strap extending therefrom, but instead of the ordinary ring and snap hook attachment, there is a ring at one end of the neck portion, and the connection between the neck and hitching portion forms a stop for the movement of the ring in one direction, while a spring stop limits the movement of the ring in the opposite direction, the hitching portion being wholly separated from the ring.

MAKING ALUMINATE.—Dmitry A. Péniakoff, Huy, Belgium. This invention is for a process for producing alkaline aluminates and chlorine by heating a substance containing alumina in the presence of an alkaline sulphate a d sulphuret, the sulphurous acid gas obtained being mixed with oxygen and then brought in contact with alkaline chloride, to produce chlorine and alkaline sulphate. The whole process is very simple, and has also been patented in many foreign countries.

BICYCLE SKIRT.—Julius N. Lewinson, New York City. This is an improvement in divided skirts and trousers combined, according to which the rear portion of the skirt is so made that it may, for a portion of the distance from the waistband down, be readily opened, and when the opening is closed an apron will cover the skirt opening, so that the skirt at the back upper portion will have the appearance of an ordinary walking skirt.

AWNING.—Charles A. and William E. Metzger, Rutland, Vt. This invention provides simple and inexpensive means for hanging an awning, the hanging devices not being removed when the awning is disconnected from its support. The devices do not detract from the appearance of the awning, and when the latter is drawn up its folds do not interfere with the pulley through which the draw rope passes. The invention also provides hangers especially adapted for attachment to a rod used as a support for the awning, the hangers being attachable at any point on the rod and readily attached or removed.

FISH NET LIFTING DEVICE.—John W. Atwood, Malden, Mass. This is a lifting machine for taking up nets, trawls, or set lines or ropes, and consists principally of a revoluble drum carrying at its periphery clamps adapted to engage the net or line and release it after drawing it a suitable distance. Each clamp consists of an elastic block whose top is engaged by an adjustable plate, while a movable block directly opposite is actuated by a lever pivoted on the drum. The drum carrying shaft is revolved by an engine or other motor, and a revolving brush removes the line or net from the clamps as soon as they open.

PLUMB SUPPORT.—John H. Weir, New York City. This is a device for the use of masons, carpenters, etc., to permit of quickly lowering the bob without imparting to it a swinging motion. Within a suitable casing adapted to be held in one hand, and having at its lower end a lug to which one end of the cord is attached, are two outwardly springing arms having inner bent perforated portions through which the return portion of the cord is passed, the pressing inward on the arms by the thumb and finger bringing the perforations in line and permitting the cord to run freely, while the cord is locked when the pressure on the arms is released.

VEHICLE RUNNING GEAR.—Benjamin F. Haldeman, Pittsburg, Pa. For farm, coal and similar wagons, this invention provides a substitute for the rigid reach ordi arily used to connect the front and rear axles. It is particularly applicable to wagons having a rear platform spring, and consists of an inverted U-shaped lever and links connected with the rear axle and fifth wheel, a spring rigidly secured to the fifth wheel being flexibly connected at its rear end with the lever. The improvement is self-adjusting to the load and allows the front wheels to be turned u der the body.

GATE.—Albert Davison, Belvidere, Ill. This is a farm gate which may be readily lifted to set it above the snow or to let small animals pass through, and such adjustment may be easily effected without detaching any of the operating parts, the bolt seats permitting its latching and unlatching at different vertical adjustments. The several parts for raising and letting down the gate are arranged to operate without opening or shutting it, facilitating the work of farmers in separating small from large stock.

GATE LATCH.—William J. Hays, Decatur, Ill. In combination with a gate having a vertical bar and a keeper at its free edge, according to this improvement, are two latches pivoted to the ends of the bar and projecting beyond the front end of the gate to engage the strikes, while a lever pivoted at its lower end to the inner end of the lower latch carries a pin which overhangs the inner end of the upper latch, the upper end of the lever engaging a cross wire to lock the two latches.

ROLLER SKATE.—George T. Bond, Topeka, Kansas. The skate, according to this improvement, is made with a single roller, some six inches high or thereabout, and having a hub, wire spokes and a pneumatic tire. A supporting frame with side uprights, braces and leg strap are designed to give efficient support to the leg and ankle of the skater, the improved skate being adapted for general out-of-door use.

FRUIT DRIER.—Arthur B. Shearer, Arroyo Grande, Cal. According to this invention, a main compartment is provided with end doors and a track between for the tray cars, there being at one side of the track a condensing wall or partition cooled by a water spray and a blast of cool air, while a fan forces hot air from a heater or furnace across the track space and its fruit laden cars against the condenser wall. A blower is provided for withdrawing the air from the drying chamber and returning it to the furnace. The cars are provided with a horizontally turning rack adapted to receive any desired number of fruit trays.

BEDSTEAD JOINT.—Daniel D. Curtis, Sidney Center, N. Y. This is a bed rail fastener designed to be very secure and without vertical or lateral motion, taking also the weight of the rail from the screws attaching the body of the fastener to the rail. It is preferably made of metal, and has rear openings or apertures and forward hooks to enter sockets in the head and foot boards, and the bottom of the body is provided with two or more horizontal flanges, which are preferably integral with the body and struck up therefrom.

FOLDING COT.—David T. Helprin, New York City. This is a cot which folds, not only in the direction of its sides, but also in the direction of its ends, by which it may be made to occupy a small space in storing it, but may be readily brought fully out into rigid position as a cot. The frame consists of side bars having a hinge connection, and with sockets at their outer extremities, the legs being pivotally attached to the socket portions, while cross bars have heads arranged to enter the sockets and engage with the legs, the bed section being attached to the cross bars and sections of the side bars, the bed being cut away opposite the sockets.

NON-REFILLABLE BOTTLE.—Dolph Edwards, Sanford, Fla. To provide a bottle which cannot be refilled without partially destroying it, according to this invention, the neck of the bottle is made with an internal circumferential groove, to which leads a perforation from the exterior. The neck is long enough to receive a lower sealing plug, and an upper securing plug, the latter having a groove coinciding with the internal groove of the neck and permitting of the insertion of a key of wire or other suitable material in the coincident grooves to lock the securing plug in place. By forcing the wire entirely in, so that it cannot be withdrawn, the contents of the bottle cannot be obtained without breaking off the neck at a circularly grooved portion between the two plugs, although, by leaving the key with a protruding portion, it may be withdrawn and the sealing plug removed, allowing the bottle to be used as an ordinary bottle.

Designs.

LADY'S COLLAR.—David Kisch, New York City. This design is for a collar open at the back, and with two opposite side portions having angular front points and an intermediate piece with downwardly extending a gular lower edge.

SOAP DISH OR HOLDER.—Edward L. Snyder, Brooklyn, N. Y. This dish has a top which slopes downward from its margin to a central opening, communicating with an enlarged space below, there being an end opening in the body of the dish to this space.

PICTURE FRAME.—Alfred J. Ripley, Long Branch, N. J. This is a frame made with a surface representing cloth decorated with playing cards and chips, and having also a depression simulating a "kitty" opening.

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(7052) D. L. S. says: In SCIENTIFIC AMERICAN of October 31, 1896, Notes and Queries column, question No. 7002. Please tell me what gold size is and how made, or where it can be obtained. How is good sizing made? A. 1. (Oil size.) Drying or boiled oil thickened with yellow ocher or calcined red ocher, and carefully reduced to the utmost smoothness by grinding. It is thinned with oil of turpentine. Improves by age. Used for oil gilding. 2. (Water size.) Parchment or isinglass size mixed with finely ground yellow ocher. Used in burnished or distemper gilding. 3. Place boiled oil in a stone pot and place on a gentle fire, and allow the heat to rise almost to the point of ignition, then set fire to it, and let it burn until it is thick, then put on the cover to extinguish the flames. Strain through silk and thin with turpentine.

(7053) L. J. H. says: Please give through the columns of the SCIENTIFIC AMERICAN a formula for making a cement to hold two pieces of glass together. A. The Pharmacist recommends the following as a proved recipe: Take 1 ounce of Russian isinglass, cut it in small pieces, and bruise well, in order to separate the fibers; then add 6 ounces of warm water, and leave it in a warm place that the isinglass may dissolve, which will require from 34 to 48 hours. Evaporate this to about 3 ounces. Next dissolve ½ ounce mastic in 4 ounces of alcohol, and when this is ready, transfer the isinglass from the evaporating dish to a tin can (an empty ether can will be found convenient), heat both solutions, and add the mastic solution to the isinglass in small quantities at a time, shaking the can violently after each addition. While still hot strain the liquid through muslin cloth and put up in ½ ounce bottles. This cement is very valuable, and articles, such as mortars, graduates, etc., mended by it have been in use for years.

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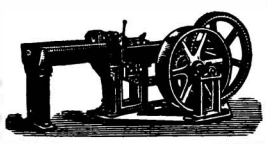

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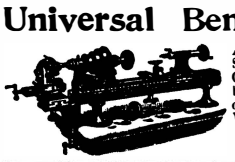

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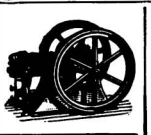

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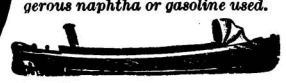

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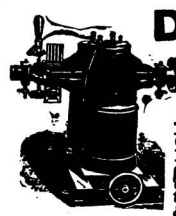

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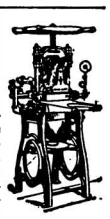

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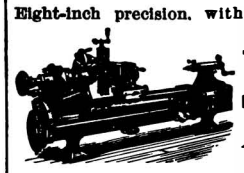

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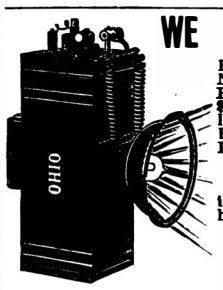

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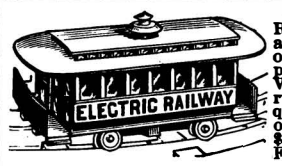

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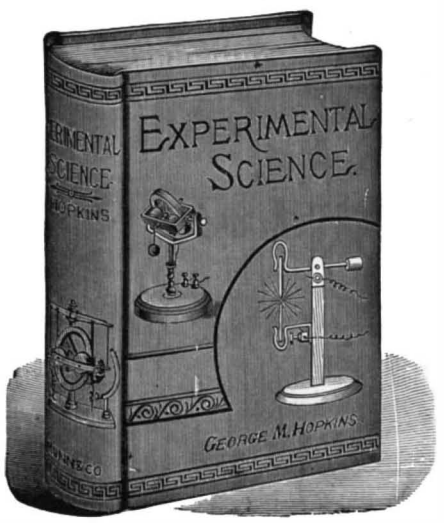

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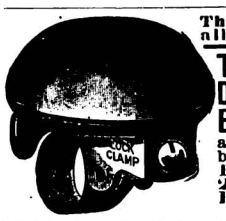

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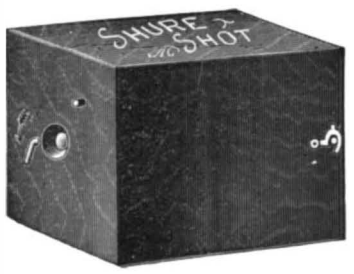

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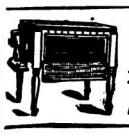

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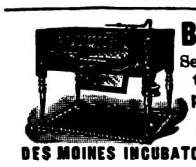

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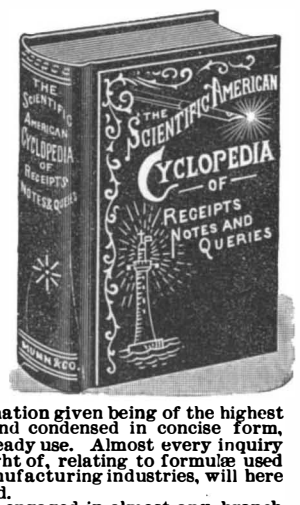

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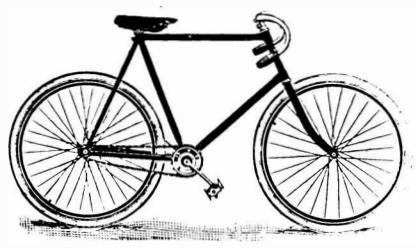

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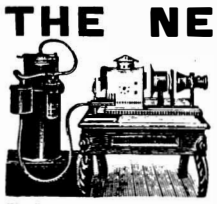

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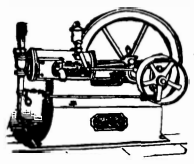

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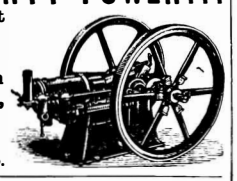

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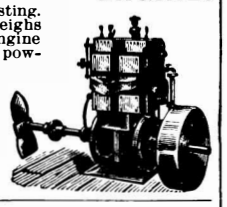

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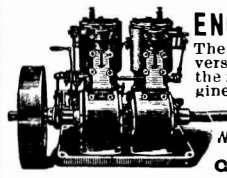

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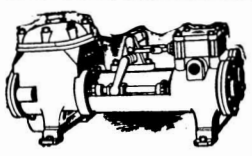

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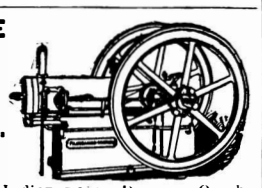

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